CHAPTER V

TAXONOMIC TREATMENT

5.1 Materials and methods

5.1.1 Plant materials

Grass specimens of the subtribe Ischaeminae and the subtribe Rottboelliinae were studied from existing herbarium specimens deposited at the Department of Systematic Botany, University of Aarhus (AAU); Kasin Suvathabhandhu Herbarium, Department of Botany, Chulalongkorn University, Bangkok (BCU); Herbarium, Botanical Section, Department of Agriculture, Bangkok, Forest Herbarium (BK); National Park, Wildlife and Plant Conservation Department, Bangkok (BKF); British Natural History Museum Herbarium (BM); Botanical Museum, University of Copenhagen (C); Chiang Mai University Herbarium (CMU); Royal Botanic Garden, Edinburgh (E); Royal Botanic Gardens, Kew (K); Khon Kaen University Herbarium (KKU); National Herbarium Netherland University of Leiden branch (L); Linnean Society Herbarium (LINN); Muséum National d'Histoire Naturelle, Paris (P); Prince of Songkhla University Herbarium (PSU); Queen Sirikit Botanic Gardens, Herbarium (QBG); Department of Biology Herbarium, Chiang Mai University and Trinity College, University of Dublin (TCD).

Addition collections of grass specimens also collected from their natural habitats from various localities throughout Thailand. Specimens were collected using standard procedures for herbarium materials (Bridson & Forman, 1999).

5.1.2 Specimen determination

Determinations of the collected specimens were based on the existing keys available from Floras or manuals of neighboring countries. Then the identifications were confirmed by comparing with the type specimens.

5.1.3 Classification

In this work, genera have been arranged according to the Clayton & Renvoize classification (1986).

5.1.4 Taxonomic treatments

Taxonomic treatments of genera and species in the subtribe Ischaeminae and Rottboelliinae were based mainly on morphological data. Each genus and species were described and illustrated. Keys to subtribes, genera and species were constructed. Ecological and geographical data of each species were noted.

5.2 Results

According to the examination of plant collections from the herbarium and addition collections in the fields in Thailand during July 2004-July 2006, 18 taxa in subtribe Ischaeminae and 33 in Rottboelliinae are enumerated.

KEY TO THE SUBTRIBES

1. Rachis internodes and pedicels slender, sometimes thickening upwards, upper lemma awned **A. Ischaeminae**
1. Rachis internodes and pedicels stout, thickening upwards; upper lemma awnless **B. Rottboelliinae**

A. ISCHAEMINAE

Presl, Rel. Haenk. 1: 328. 1830.

Apludinae Hook.f., Fl. Brit. Ind. 7: 4. 1897.

Perennial or annual. *Inflorescence* of single, paired or digitate racemes, theses usually terminal, sometimes axillary, rarely spathe; racemes with slender and fragile rachis. *Spikelets* paired (except *Apluda*), dissimilar. *Sessile spikelet* bisexual, dorsally or laterally compressed; *lower glume* chartaceous to crustaceous, convex or concave, 2-keeled or rounded on the flanks, with or without a median groove; lower floret male, with palea; *upper lemma* oblong, bidentate or bifid, nearly always with a glabrous awn. *Pedicelled spikelet* variable.

About 8 genera, distributed throughout the tropics, 5 genera, 17 species and 1 infraspecific taxa in Thailand.

KEY TO THE GENERA

1. Pedicelled spikelet absent **5. Thelepogon**
1. Pedicelled spikelet present
 2. Spikelet 3; subtended by cymbiform spathes; 1 sessile and 2 pedicelled spikelet **1. Apluda**
 2. Spikelet 2; not subtended by cymbiform spathes; 1 sessile and the other one pedicelled spikelet
  3. Racemes usually 2 or more **3. Ischaemum**
  3. Racemes single
   4. Inflorescence subtended by a linear spatheole which enclosed, sessile spikelets laterally compressed, pedicelled spikelet smaller than sessile spikelet **2. Kerriochloa**
   4. Inflorescence not enclosed by spatheole, sessile spikelets dorsally compressed, pedicelled spikelet larger than sessile spikelet **4. Sehima**

1. APLUDA

L., Sp. Pl. 1: 82. 1753.— Type species: *A. mutica* L.

Calamina P. Beauv., Ess. Agrost.: 128. 1812. *nom. superfl. pro. Apluda.*

Perennial grass. *Culms* hard and tall. *Leaf-sheaths* tight. *Ligules* membranous. *Leaf*-blades linear, flat. *Inflorescence* a large panicle on terminal or axillary, consiting of numerous racemes. *Spikelets* in threes, 1 sessile and 2 pedicelled spikelets, each are subtended by cymbiform spathes, borne on a minute peduncle. *Sessile spikelet* laterally compressed. *Florets* 2; lower sterile, upper perfect. *Glumes*; lower glume coriaceous, convex, without keel and wing, awnless; upper glume boat-shaped, awnless. *Upper lemma* awn or awnless. *Pedicelled spikelet* 2, 1 neuter the other ones with 2 male, awnless. *Lodicules* 2, cuneate. *Stamens* 3. *Stigmas* laterally exerted. *Caryopsis* oblong.

This genus comprises probably only one polymorphic highly variable species, which is very common throughout Southeast Asia, India and Ceylon. Typical found in partly shaded to mostly open places in deciduous forest.

1. Apluda mutica L., Sp. Pl. 1: 82. 1753.— Type: India, *Herb. Linn.* 1213.1 (lectotype LINN!).

A. varia Hack. in DC., Monogr. Phan. 6: 196. 1889.— Type: Wall. Cat. no. 8760, 8761 (K).

Perennial grass. *Clums* hard, solid 50–150 m tall or more, glabrous. *Leaf-sheaths* tight, 4.5–7 cm long, grooved, glabrous. *Ligules* membranous, 1.5–2 mm long. *Leaf-blades* linear, up to 1.5 by 30 cm, strigose on both surfaces, base attenuate, apex acuminate. *Inflorescence* consiting of numerous racemes, 3 spikelets subtended by cymbiform spathes with long aristate at the apex, the lower most with an inflated joint. *Sessile spikelet* 1, perfect, laterally compressed. *Glumes*; lower glume oblong-lanceolate, 4–6 mm long, 11–13-nerved, coriaceous, adaxial surface scaberulous, margins thin, hyaline and folded, awnless; upper glume asymmetrically boat-shaped, 4–5 mm long, 6–7-nerved, margins folded, apex acute to acuminate, awnless. *Lower floret* sterile; lemma 4–5 mm long, 5-nerved, hyaline apex acuminate, awnless; palea boat-shaped, 2-nerved, hyaline. *Upper floret* perfect; lemma boat-shaped 3.5–4 mm long, expanded below the middle, hyaline, awn or awnless; palea lanceolate, 2-nerved, hyaline, acuminate. *Pedicelled spikelet* 2; one with only flattened pedicel and solitary glume, the other one with oblong pedicel, 3–3.5 mm long, flattened, glabrous. *Glumes*: lower glume oblong-ovate, 4–4.5 mm long, 11–12-nerved, papyraceous, acute; upper glume boat-shaped, *ca.* 4 mm long, 10–11-nerved, chartaceous, expanded margin, acute. *Lower floret* neutral; lemma ovate, 4–4.5 mm long, 3-nerved, hyaline, marginal winged; palea hyaline, 3.5–4 mm, 2-nerved. *Upper floret*; lemma boat-shaped, 3–3.5 mm long, 5-nerved, hyaline, acute; palea boat-shaped, 2–2.5 mm long, 2-nerved, hyaline. *Lodicules* cuneate, *ca.* 0.25 mm long. *Anthers* yellow, *ca.* 2 mm long. *Ovary* fusiform, 1–1.5 mm long. *Stigma* brown (Figs. 5.1 & 5.27A).

Thailand.— NORTHERN: Mae Hong Son [Ban Mae La Luang, 15 Jan. 1965, *S. Phengnaren* s.n. (BKF); Ban Mu Village, Mueang, 20 Feb. 1979, *T. Koyama et al.* 15,443 (AAU, BKF)], Chiang Mai [11 Oct. 1911, *A.F.G. Kerr* 2155 (BM, E, K, TCD); Doi Chiangdao, 28 Jan. 1913, *A.F.G. Kerr* 2867 (BM, K); 11 Nov. 1905, *K.B.* 1189 (BKF); 15 May 1955, *T. Smitinand* 2724 (BKF); 20 Nov. 1955, *Ploenchit* 893 (BKF, K); 16 Feb. 1958, *Th. Sørensen et al.* 1231 (C), 1244 (C); 17 Feb 1958, *Th. Sørensen et al.* 1265 (C); 7 Dec. 1959, *T. Smitinand & E.C. Abbe* 6254 (BKF, K); 3 Dec. 1961, *T. Smitinand & Anderson* 7341 (BKF, K); 28 Oct. 1979, *T. Shimizu et al.*

21028 (BKF); 15 Dec. 1990, *J.F. Maxwell* 90-1354 (CMU, L); Lao Kao Nok, 18 Sept. 1914, *A.F.G. Kerr* s.n. (BM); Doi Suthep, E side, below Doi Suthep temple, 25 Oct. 1949, *Ploenchit* 88 (BKF, K); 12 Dec. 1957, *T. Smitinand* 16803 (BKF, K); 10 Feb. 1958, *Th. Sørensen et al.* 977 (BKF, C); 4 Dec. 1958, *Th. Sørensen et al.* 2640 (C); 26 Oct. 1958, *Th. Sørensen et al.* 5920 (C, K); 18 Dec. 1958, *Th. Sørensen et al.* 6496 (C, E, K); 10 Nov. 1987, *J.F. Maxwell* 87-1396 (BKF, CMU, L); 21 Nov. 1993, *A. Phuakam* 82 (L); 22 Nov. 2005, *P. Traiperm* 297 (BCU, BKF, KKU); Wang Tao, N of Chiang Mai, 13 Feb. 1958, *Th. Sørensen et al.* 1059 (BKF, C, E); Pha Hom Pok, 25 Feb. 1958, *Th. Sørensen et al.* 1677 (C); E of Fang, 28 Feb. 1958, *Th. Sørensen et al.* 1802 (C); SW part of Doi Chang Mae Taeng, 24 Oct. 1979, *T. Shimizu et al.* T-20725 (BKF); Op Luang Gorge, off the Hot Mae-Saring highway, along Mae Jam river, Hot, 21 Dec. 1989, *J.F. Maxwell* 89-1574 (CMU, E, L); 23 Nov. 2005, *P. Traiperm* 304 (BCU, BKF, KKU); Doi Mueang Awn, W side area, San Kam Paeng, 17 Nov. 1995, *P. Palee* 348 (L); Mae Taeng, Doi Sahng Liang, S side, upper Gu Gahp Valley, Pah Dang (red Lahu) Village area; Geut Chang, 7 Nov. 1997, *J.F. Maxwell* 97-1307 (BKF, L); Den (Karen) village, Royal Project area; Ban Wat Chan: Mae Jam, 4 Dec. 1998, *J.F. Maxwell* 98-1409 (BKF); at pass *ca.* 25 km along road Mae Rim-Samoeng, 12 Oct. 2001, *S. Laegaard* 21704 (AAU); km 24-28 along road Mae Rim-Samoeng, 21 Oct. 2001, *S. Laegaard* 21769 (AAU)], Chiang Rai [km 133, 1020 road, Chiang Khong to Chiang Rai, 2 Dec. 2005, *P. Traiperm* 318 (BCU, BKF, KKU); Theng, 2 Dec. 2005, *P. Traiperm* 319 (BCU, BKF, KKU)], Lamphun [Doi Khun Tan National Park, Yaw 2, *J.F. Maxwell* 93-1334 (L)], Lampang [21 Dec. 1973, *Ch. Charoenphol* 409 (BKF); Wahng National Park, N Part, Wahng Die; Pah Ngham (Nahn Kaht) limestone mountain area; middle elevation of Maw Cave limestone hill, 19 Dec. 1996, *J.F. Maxwell* 96-1676 (BKF, L); Khun Tan National Park, 4 Dec. 2005, *P. Traiperm* 321 (BCU, BKF, KKU)], Phrae [Mae Yom National Park, W bank of the Yom river at Pah Ing station; Sahiab, 15 Nov. 1991, *J.F. Maxwell* 91-1059 (AAU, L)], Tak [Ma Bon, 5 Dec. 1957, *J. Santos* 6693 (L); Bhumipol Dam, Dec. 1959, *Sanchai* 614 (BK); Doi Pang Kluay, 22 Dec. 1965, *S. Phengnaren* s.n. (BKF); Lahn Sahng, 27 Dec. 1974, *R. Geesink et al.* 7928 (BKF, C, K, L)], Phitsanulok [Thung Salaeng Luang National Park, about 20 km E of Phitsanulok, 10 Jan. 1921, *G. Murata* T-38343 (BKF); Kang Sopa waterfalls, 13 Dec. 1966, *Prayad* 594 (BK)], Nakhon Sawan [Lahn Sahng National Park, 23 Nov. 1965, *E. Hennipman* 3108 (BKF, C, K, L, P)]; NORTH-EASTERN: Phetchabun [Chon Daen, 15 Jan. 1969, *Vacharapong* 309

(BK); Nam Nao National Park, 20 Nov. 2004, *P. Traiperm* 175 (BCU, BKF, KKU)], Loei [km 90-91, 14 Jan. 1960, *C. Chermsirivathana* s.n. (BK); Phu Kradueng, 15 Mar. 1952, *T. Smitinand* 1179 (BKF, K, L), 1858 (BKF, K), 2030 (BKF, K), 2100 (BKF, K); 27 Nov. 1965, *M. Tagawa et al.* 368 (BKF); 31 Oct. 2005, *P. Traiperm* 273 (BCU, BKF, KKU); Phu Luang, from Ban Na Luang to N ridge, 3 Dec. 1965, *M. Tagawa et al.* 1040 (BKF, E); Hw. 203, km 90-91, 14 Jan. 1982, *Y. Paisooksantivathana* y 809-82 (BK)], Nong Bua Lam Phu, [18 Nov. 1963, *M. Lazarides* 644 (BK)]; EASTERN: Chaiyaphum [Thungkamang, 15 Dec. 1971, *C.F. van Beusekom et al.* 4330 (BKF, C, K, L); 27 Nov. 2004, *P. Traiperm* 179 (BCU, BKF, KKU)], Nakhon Ratchasima [Pak Chong, 1 Jan 1924, *A. Marcan* 1574 (BM), 1593 (BM); 14 Jan. 1965, *Umpai* 177 (BK); Huai Thalaeng, 23 Dec. 1928, *Put* 2201 (BK, BM, K, TCD); Klang Dong, 9 Dec. 1962, *C. Phengklai* 405 (BKF, C, K, L)], Buri Ram [24 Nov. 1976, *C. Phengklai et al.* 3371 (BKF)]; SOUTH-WESTERN: Uthai Thani [on way to Khao Nang Rum Research Station, Huai Kha Kaeng Wildlife Sanctuary, Lahn Sak, 12 Nov. 1979, *T. Shimizu et al.* T-22435 (L)], Kanchanaburi [Tham Pha, 26 Dec. 1961, *C. Phengklai* 323 (BKF, E, K, L); Huai Bankau, 12 Nov. 1971, *C.F. van Beusekom et al.* 3719 (BKF, C, K, L, P); Sai Yok, 9 Dec. 1961, *K. Larsen* 8632 (C), 8641 (C); 19 Dec. 1961, *K. Larsen* 8821 (C)], Prachuap Khiri Khan [Cha-um, 15 Apr. 1960, *C. Chermsirivathana* s.n. (BK)]; CENTRAL: Ang Thong [24 Dec. 1928, *Put* 2545 (BK, BM, K)], Phra Nakhon Si Ayutthaya [9 Sept. 1922, *A. Marcan* 996 (BM); near Saraburi, 5 Mar. 1958, *Th. Sørensen et al.* 1937 (BKF, C, E)], Saraburi [Muak Lek, 18 Sept. 1953, *K. Suvathabhandhu* 480 (BK); Phukhae Arboretum, 25 Mar. 1950, *L. Williams* 17148 (K); 117 km N of Krung Thep Maha Nakhon, 3 Dec. 1957, *J. Santos* 6676 (L); Khao Sam Lan, 5 Nov. 2005, *P. Traiperm* 275 (BCU, BKF, KKU)], Nakhon Pathom [Pootthahmonthon, Mahidol University, Salaya Campus, 25 Jan. 1999, *J.F. Maxwell* 99-39 (L)], Krung Thep Maha Nakhon [5 Oct. 1919, *A.F.G. Kerr* 3801 (BM, K); 19 Feb. 1922, *A. Marcan 678* (BM); *E. Smith* 350 (BK, BM); 12 Feb. 1932, *Put* s.n. (BK); Bang Khen, 8 Nov. 1952, *K. Suvathabhandhu* 329 (BK)], Samut Prakan [Wat Bahng Grajow, 31 Jan. 1971, *J.F. Maxwell* 71-19 (BK)]; SOUTH-EASTERN: Chon Buri [Ban Dam, Si Racha, 5 Apr. 1920, *A.F.G. Kerr* 4163 (BM, K); 9 km N of Chon Buri, 26 Nov. 1970, *M. Lazarides* 7495 (K); Khao Khiao, Si Racha, 10 Apr. 1975, *J.F. Maxwell* 75-409 (AAU, BK, L); Sattahip, 3 Nov. 2004, *P. Traiperm* 152 (BCU, BKF, KKU)], Rayong [Klang, 29 Nov. 1964, *S. Sutheesorn* 265 (BK)], Chanthaburi [Wang Kaphae, Pong Nam Ron, 8

Oct. 1956, *T. Smitinand* 3544 (BKF); 4 Nov. 1958, *Dee* 1186 (BKF)]; PENINSULAR: Chumphon [Khao Num-Ma-Prou, Toung Kae, 1 Jan. 1974, *S. Sutheesorn* 2816 (BK)], Surat Thani [Khao Nam Ron (hot springs), Chaiya, 5 Feb. 1987, *J.F. Maxwell* 87-149 (AAU, BKF, CMU, E, L, P)].

Distribution.— Worldwide.

Ecology.— Partly shaded to mostly open places in deciduous forest, up to 2,000 m altitude. Flowering in August to May.

Vernacular.— Ya kom bang (หญ้าคมบาง) (General); Ya phai (หญ้าไผ่) (Krung Thep Maha Nakhon); Ya phrik phran (หญ้าพริกพราน) (Ang Thong).

Notes.— This species has 3 spikelets subtended by cymbiform spathes with long aristate at the apex. It is variable in the development of the awn of the upper lemma.

Uses. — The young plant is used as a fodder (Gilliland, 1971).

Figure 5.1 *Apluda mutica*: A. plant; B. inflorescence; C. three of spikelets subtended by cymbiform spathes; D. spatheole; E-F. two views of three spikelet; G. lower glume of sessile spikelet; H. upper glume of sessile spikelet; I. pedicelled spikelet; J. pedicel of sessile spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 152.

2. ISCHAEMUM

L., Sp. Pl. 2: 1049. 1753.— Type species: *I. muticum* L.

Schoenanthus Adans., Fam. Pl. 2: 38. 602. 1763, *nom. superfl. pro. Ischaemum*.

Colladoa Cav., Ic. Pl. 5: 37. 1799.— Type species: *C. distachia* Cav. (= *I. rugosum*).

Meoschium P.Beauv., Ess. Agrost.: 111. 1812.— Type species: *M. aristatum* (L.) P.Beauv.

Ischaemopogon Griseb., Fl. Br. W. Ind.: 560. 1864.— Type species: *I. latifolius* (Spreng.) Griseb.

Ischaemum subgen *Digastrium* Hack. in DC., Monogr. Phan. 6: 250. 1889.— Type species: *I. fragile* R. Br.— *Digastrium* (Hack.) A. Camus in Bull. Mus. Hist. Nat. Paris 27: 372. 1921.

Argopogon Mimeur in Rev. Bot. Appl. 31: 211. 1951.— Type species: *A. vuilletii* Mimeur (= *I. fasciculatum*).

Perennial or annual. *Inflorescence* terminal and axillary, of paired or sometimes digitate racemes, separated or conjugated 1-sided and interlocked back to back in a single spike, exserted but sometimes embraced by a spatheole; internodes and pedicels linear to obovoid, usually exposed on the back of the raceme as a U- or V-shaped segment. *Sessile spikelet* compressed; lower glume chartaceous to coriaceous, convex, 2-keeled or rounded on flanks, often rugose, sometimes winged, entire or bilobed; upper glume with or without an awn; upper lemma awnless in *I. indicum* and *I. magnum*. *Pedicelled spikelet* as large as the sessile, dorsally or laterally compressed, often asymmetrical, occasionally bisexual with the upper lemma weakly awned.

A genus of about 70 species in the Old World tropics, mainly in Asia, but a few species in tropical America; 13 species and 1 infraspecific level occur in Thailand. *Ischaemum* is a difficult genus reaching its greatest complexity in Southeast Asia and biosystematic work on the genus badly is needed.

I. angustifolium Hack., *I. fieldingianum* Rendle and *I. mangaluricum* (Hack.) Stapf ex Fisher have been reported from Thailand (see Nanakorn & Norsaengsri 2001) but no herbarium specimens are available for confirmation.

KEY TO THE SPECIES

1. Spikelets awnless, awn imperfect, not kneed, rarely 1 cm long or with a weak awn hardly exserted from the glumes
   2. Lower glume oblong on the lower part, upper part obique foliose and acute at the apex, slightly winged along the upper margins; racemes 9–15 cm long **7. I. magnum**
   2. Lower glume ovate, winged above the middle, racemes 2.5–3.5 cm long **8. I. muticum**
1. Spikelets distinctly awned
   3. Lower glume of sessile spikelet coarsely ridged across the back or with nodules along the margins
      4. Lower glume of sessile spikelet coarsely ridged across the back with 4–7 ridges **9. I. rugosum**
      4. Lower glume of sessile spikelet coarsely ridged with nodules along the margins
         5. Lower glume of sessile spikelet indurate below, without nerve
            6. Pedicelled spikelet as long as the sessile one, lower glume with 2-3 transverse ridges or nudules at each edge **1. I. barbatum**
            6. Pedicelled spikelet shorter than the sessile one, lower glume with 4-7 transverse ridges or nudules at each edge **9. I. rugosum**
         5. Lower glume of sessile spikelet subcoriaceous, with 10–14 distinct nerve
            7. Back of the lower glume of sessile spikelet glabrous **4. I. hubbardii**
            7. Back of the lower glume of sessile spikelet hairy **12. I. sp.1**
   3. Lower glume of sessile spikelet not coarsely ridged across the back or with nodules along the margins
      8. Plant often with 3 racemes **10. I. tenuifolium**
      8. Plant normally with 2 racemes
         9. Lower glume of sessile spikelet without winged **11. I. timorense**
         9. Lower glume of sessile spikelet with conspicuously winged
            10. Back of the lower glume of the sessile spikelet glabrous
               11. Inflorescences raceme, conjugated **2. I. hansenii**
               11. Inflorescences digitately raceme, separated **5. I. indicum**

10. Back of the lower glume of the sessile spikelet slightly hairy to densely hairy
    12. Leaf blade pilose without tubercle-based hair
        13. Lower glume of the sessile spikelet with distintly 2-apical wings **5. I. indicum**
        13. Lower glume of the sessile spikelet with narrowly fringed wings along the upper margins **3. I. hirtum**
    12. Leaf blade glabrous or with tubercle-based hairs at least in the lower part
        14. Leaf blade pilose with tubercle-based hairs on both surfaces **6. I. lacei**
        14. Leaf blade glabrous on both surfaces, pilose with tubercle-based hairs on the lower surface **13. I. sp.2**

1. Ischaemum barbatum Retz., Observ. Bot. 6: 35. 1791.— Type: Indonesia, Java, *D. Wennerberg* s.n. (not seen).

I. barbatum Retz. var. *glaberrimum* Bor in Dansk Bot. Arkiv (20) 2: 174. 1962. *syn. nov.*— Type: Thailand, Chiang Mai: Doi Suthep, common in a bog, alt. 1000 m, 14 April 1958, *Th. Sørensen, K. Larsen & B. Hansen* 2709 (holotype K!, isotypes BKF!, C!, E!).

Andropogon elatus (Nees) Steud., Syn. Pl. Glum. 1: 376. 1854.— Type: India, Silhet, *Wall. Cat. no.* 8861 (holotype K!).

I. aristatum L. subsp. *imberbe* Hack. var. *imbricatum* Hack. in DC., Monogr. Phan. 6: 203. 1889.— Type: India, Khasia, *J.D. Hooker & T. Thomson* s.n. (lectotype K!, selected here).

I. aristatus L. var. *arfakense* Rendle in Gibbs, Dutch N.W. New Guinea. 89. 1917.— Type: New Guinea, Arfak mountains, Angi lakes, common in open marsh by lake, *L.S. Gibbs* 5564 (lectotype K!, selected here).

I. barbatum var. *arfakense* (Rendle) Ohwi, Bot. Mag. Tokyo. 56: 11. 1942.

KEY TO THE VARIETIES

1. Raceme glabrous — **a. var. barbatum**

1. Raceme hairy — **b. var. lodiculare**

a. var. barbatum

Perennial. *Culms* erect somewhat prostrate, terete, up to 1 m tall, internodes glabrous, nodes glabrous or slightly pilose. *Leaf-sheaths* loose and overlapping below, glabrous or with pilose hairs or densely appressed hairs. *Ligules* prominently membranous, 1–4 mm long, glabrous or pilose outside. *Leaf-blades* narrowly linear to linear-lanceolate up to 20 by 0.5–1.5 cm, glabrous to pilose on both surfaces, rounded or subcordate or abruptly narrowed at the base, apex acute to acuminate. *Inflorescence* racemose on terminal or axillary, 5–11 cm long, conjugate with 2 racemes, rachis internodes oblong, 3–6 mm long, tough, pilose along the angles, nodes with a ring of long cilia, callus triangular, blunt *ca.* 1.5 mm long, pilose at base. *Sessile spikelet* dorsally compressed. *Glumes*; lower glume varying in size and shape, oblique-oblong, 5.5–8 by 1.5–2 mm, upper part foliose, indurate below, not nerved, with 2–3 transverse ridges or nodules at each edge and rarely extending horizontally to meet across the back of the glumes, glabrous on the back, asymmetrically with 2 small fringed marginal wings on the 1/3 of the upper, submarginally keeled towards the apex, keels unequally and narrowly winged, wing widest on side away from pedicelled spikelket; upper glume folded, 5–7.5 by *ca.* 1 mm, scabrous keeled on the back of the nerve, glabrous on the back or villous. *Lower floret*; lemma oblong-acute, 4.5–7 by *ca.* 1 mm, hyaline, margins slightly folded, upper margins ciliate; palea oblong-acute, 3–6.5 by *ca.* 1 mm, hyaline, folded. *Upper floret*; lemmas 3.5–5 mm long, hyaline, bifid, geniculately awned from sinus, awn twisted, 18-25 mm; upper palea oblong, 3–4.5 mm long, hyaline, folded. *Pedicelled spikelet*: pedicels triangular-shaped, 2.5–3 mm long, pilose along the angles. *Glumes*; lower glume oblong, 4.5–7 by 1.5–2 mm, upper foliose and many nerved, apex with a wide fringed wing its whole length on one side, indurate below; upper glume boat-shaped, 4.5–6.5 mm long, 1-keeled along the back, keel scabrous, glabrous on the back or pilose on the lower part, apex acute. *Lower floret*; lemma oblong-acute, 4–6 by *ca.* 1 mm, hyaline, folded; palea oblong-acute, 3.5–5.5 by *ca.* 0.8 mm, hyaline, folded. *Anthers ca.* 2.5

mm long. *Upper floret*; lemma boat-shaped, 4–5 by *ca.* 0.8 mm, hyaline, folded, apex acute; palea oblong-obtuse, 3–4 by *ca.* 0.8 mm, hyaline, folded (Fig. 5.27B. & C).

Thailand.— NORTHERN: Chiang Mai [Doi Suthep, 7 May 1910, *A.F.G. Kerr* 1166 (BM, E, K); 4 Oct. 1958, *Th. Sørensen et al.* 2594 (BKF, C); 14 Apr. 1958, *Th. Sørensen et al.* 2709 (BKF, C, E, K); 15 Aug. 1990, *J.F. Maxwell* 90-884 (AAU, CMU, L); 25 Oct. 1958, *Th. Sørensen et al.* 5889 (C, E, K); 10 Apr. 1958, *K. Larsen* 259 (K); Ban Watchan, Sameung, 19 Jan. 1988, *R. Pooma & W. Werner* 42 (BKF); Doi Pui, 15 Aug. 1990, *J.F. Maxwell* 90-884 (AAU, CMU, L); Mae Rim, 21 Jul. 1996, *BGO. Staff* 6926 (QBG)]; NORTH-EASTERN: Loei [Phu Kradueng, 3 Oct. 1952, *T. Smitinand* 1127 (BKF), 1137 (BKF); 23 Mar. 1954, *T. Smitinand* 1793 (BKF, F); 17 Sept. 1954, *T. Smitinand* 1936 (BKF, K); *Dee* 46 (BKF); 9 May 1967, *T. Shimizu et al.* T-9024 (BKF); 23 Nov. 1984, *G. Murata et al.* T-42970 (BKF); 9 May 1988, *H. Koyama* T-61567 (BKF), T-61568 (BKF); Phu Ruea, 24 Jul. 2004, *P. Traiperm* 118 (BCU, BKF, KKU), 120 (BCU, BKF, KKU)], Udon Thani [Mueang, 10 Oct. 2004, *P. Traiperm* 129 (BCU, BKF, KKU)], Nong Khai [Phu Woe, 16 Oct. 2005, *P. Traiperm* 215 (BCU, BKF, KKU)], Sakon Nakhon [Phu Phan, 24 Dec. 1961, *P. Suvarnakoses* 1994 (K); 16 Nov. 1963, *Ploenchit* 1902 (BKF); 6 Nov. 2004, *P. Traiperm* 154 (BCU, BKF, KKU); 3 Oct. 2005, *P. Traiperm* 206 (BCU, BKF, KKU)], Maha Sarakham [km 21 on road 208 Maha sarakham-Khon Kaen, 26 Oct. 2001, *S. Laegaard et al.* 21802B (AAU, L)]; EASTERN: Chaiyaphum [Thungkamang, 15 Dec. 1971, *C.F. van Beusekom et al.* 4291 (BKF, C, K); 27 Nov. 2004, *P. Traiperm* 181 (BCU, BKF, KKU); 19 Oct. 2005, *P. Traiperm* 221 (BCU, BKF, KKU)], Nakhon Ratchasima [Khao Yai National Park, Khao Khiao, 29 Oct. 1970, *Ch. Charoenphol et al.* 4240 (AAU)], Roi Et [Ban Ngo Pa Yang, Mueang, 10 Jun. 1982, *Y. Paisooksantivathana & S. Sutheesorn* y 1080-82 (BK)], Si Sa Ket [12 Feb. 1959, *Ploenchit* 1501 (BKF, K); en route from Si Sa Ket city to Ubon Ratchathani, 10 Oct. 1984, *G. Murata et al.* T-318117, (BKF)], Ubon Ratchathani [Pa Dong Na Tham, Khong Chiam, 16 Oct. 1998, *C. Niyomdham* 5625 (AAU, BKF); surrounding of camp Marine Resort, Khong Chiam, 28 Oct. 2001, *S. Laegaard et al.* 21850 (AAU, L); km 10, 2112 road to Khong Chiam, 23 Oct. 2005, *P. Traiperm* 250 (BCU, BKF, KKU); km 36, 217 road, 22 Oct. 2005, *P. Traiperm* 234 (BCU, BKF, KKU)]; CENTRAL: Saraburi [Sam Lan forest, Mueang, 8 Sept. 1974, *J.F. Maxwell* 74-898 (AAU, BK, L)], Nakhon Nayok [near Nong Khing in Khao Yai National Park,

13 Oct. 1984, *G. Murata et al.* T 52242 (BKF)], Krung Thep Maha Nakhon [12 Oct. 1923, *A.F.G. Kerr* 7930 (BK); Bang Khen, 15 Jan. 1975, *Umpai* 522 (BK)]; SOUTH-EASTERN: Chon Buri [Pong Nam Ron, Hindat, 10 Aug. 1956, *T. Smitinand* 3549 (BKF)], Chanthaburi [Plain of Makham, 12 Jan. 1958, *Th. Sørensen et al.* 169 (C); 19 Nov. 2005, *P. Traiperm* 288 (BCU, BKF, KKU); 25 Nov. 1970, *M. Larzarides* 7463 (C, K)], Trat [Mueang, 25 Dec. 2005, *P. Traiperm* 352 (BCU, BKF, KKU); Khlong Yai, 2 Nov. 1951, *T. Smitinand* 4980 (BKF); 25 Dec. 2005, *P. Traiperm* 353 (BCU, BKF, KKU); Huai Rang, 21 Jun. 1952, *T. Smitinand* 1405 (BKF)]; PENINSULAR: Ranong [on roadside, 26 Oct. 2004, *P. Traiperm* 150 (BCU, BKF, KKU)], Surat Thani [Kanchanadit, 1 Aug. 1927, *A.F.G. Kerr* 13070 (BK, BM, K)], Phangnga [Koh Korkao, 29 Apr. 1967, *S. Sutheesorn* 2494 (BK)], Phatthalung [Sak, 1 May 1930, *A.F.G. Kerr* 19268 (BK, K); Thale Noi, 19 Mar. 1942, *P. Sukkaewmanee* PK 72, (PSU); 21 Oct. 2004, *P. Traiperm* 140, (BCU, BKF, KKU)], Trang [Thaleng Hawng, 29 Aug. 1955, *T. Smitinand* 3022 (BKF, K); Thung Kai, 13 Oct. 1992, *A.S. Barfod & T. Burholt* 43853 (AAU); 25 Oct. 1993, *K. Larsen* 43991 (L); 15 Sept. 1996, *BGO. Staff* 134 (QBG); 22 Oct. 2004, *P. Traiperm* 142 (BCU, BKF, KKU), 143 (BCU, BKF, KKU)], Satun [Kuan Gah Long, Nikhom Sahng Eng, Soi 6, Kuan Cah Long, 10 Oct. 1986, *J.F. Maxwell* 86-774 (CMU, L, PSU); Thale Ban, 4 Nov. 1990, *K. Larsen et al.* 41125 (AAU, PSU)], Songkhla [Kampengpet, 25 Jul. 1920, *A.F.G. Kerr* 15905 (BK, BM, K), 15984 (BK, BM, K); Thepa, 23 Mar. 1928, *A.F.G. Kerr* 14705 (BK, BM); Rattaphum, 21 Dec. 1965, *Umpai* 280 (BK); Rubber Research Institutes, 5 May 1970, *S. Sutheesorn* 1712 (BK); Prince of Songkla University, Hat Yai, 4 Dec. 1975, *A. Yiamudom* 26 (PSU); Ban Thom Island Sating, Lake Songkhla, 21 Oct. 1983, *P. Sirirugsa* 671b (PSU); 1 Aug. 1976, *P. Sirirugsa* s.n. (BKF); Hat Yai, near Kwan Sahdaw village, 20 Nov. 1984, *J.F. Maxwell* 84-449 (BKF, PSU); Hat Yai, Khlong Hoi Khong, W of Thoong Loong, 6 Jun. 1985, *J.F. Maxwell* 85-578 (AAU, BKF, E, L, PSU); Ton Pliew near Ton Nga Chang, 13 Oct. 1991, *K. Larsen et al.* 42352 (AAU, PSU); km 54 on road to Pattani, 19 Oct. 2004. *P. Traiperm* 135 (BCU, BKF, KKU)], Pattani [Thung Yang Daeng, 30 Oct. 2001, *R. Pooma et al.* 3126A (BKF)], Narathiwat [Pa Wai, Su Ngai Pade, 6 Aug. 1987, *C. Niyomdham* 1468 (AAU, BKF, C); Kok Kun Bet, Tak Bai, 2 Sept. 1987, *C. Niyomdham & D. Sriboonma* 1511 (AAU, BKF, C, E, K, L, P)].

Distribution.— India and Southeast Asia.

Ecology.— Tufted grass common in paddy fields and wet places, up to 1500 m altitude. Flowering throughout the year.

Vernacular.— Ya yon hu (หญ้าขอนหู) (Peninsular); Ya wai (หญ้าหวาย) (Trat); Ya hang khang (หญ้าหางค่าง) (Loei); Ya daeng (หญ้าแดง), Ya wai dang (หญ้าหวายแดง) (Narathiwat).

Notes.— This is a widespread and polymorphic species, to which many specific and infraspecific names have been applied. Variation depends mainly on the degree of hairiness of the leaves and spikelets and the number and prominence of the nodules and ridges on the sessile spikelet. In extreme cases the ridges are particularly well-developed and approach the condition in *I. rugosum*, but such plants can be recognised as *I. barbatum* by their more robust, perennial habit and more oblong sessile spikelets.

b. var. lodiculare (Nees) Jansen, Reinwardtia 2: 294. 1953.

Meoschium lodiculare Nees in Hook. & Arn., Beech. Voy.: 246. 1838.— Type: *Meyen, Millet, G.H. Vachell* (not seen).

I. aristatum subsp. *barbatum* var. *lodiculare* (Nees) Hack. in DC., Monogr. Phan. 6: 205. 1889.— Type: China, Cap Syng-Moon (*Meyen*); Hong-Kong (*Hance* 1257); Futschan-yen (ex *Debeaux*) (not seen).

Spikelets with long, white hairs. Joints of the racemes ciliate on all the sides. Sheaths usually long-hirsute, nodes bearded (Fig. 5.27D).

Thailand.— NORTH-EASTERN: Phetchabun [Thung Salaeng Luang, 17 Nov. 2005, *P. Traiperm* 284 (BCU, BKF, KKU)]; Loei [Phu Luang, 15 Nov. 1968, *C. Chermsirivathana* 1096 (BK); Phu Kradueng, 19 Mar. 1948, *K. Suvathabhandhu* 151 (BK); 19 Mar. 1958, *Th. Sørensen et al.* 2314 (BKF, C, K); 29 Nov. 1958, *Th. Sørensen et al.* 6328 (C, E, K); 15 Dec. 1963, *Umpai* 111 (BK); 16 Mar. 1974, *C. Chermsirivathana & T. Boonkerd* 1837 (BK), 1838 (BK); 3 Nov. 1984; *G. Murata et al.* T-42970 (BKF, L); 12 Nov. 2004, *P. Traiperm* 159 (BCU, BKF, KKU); 13 Nov. 2004, *P. Traiperm* 164 (BCU, BKF, KKU), 167 (BCU, BKF, KKU); 29 Oct. 2005, *P. Traiperm* 262 (BCU, BKF, KKU), 263 (BCU, BKF, KKU)], Udon Thani [Ban Nakha, 24 Dec. 1964, *C. Chermsirivathana* 231 (BK)], Nong Khai [Phonpisai, 19

Nov. 1963, *Pradit* 704 (BK); Phu Woe, 16 Oct. 2005, *P. Traiperm* 217 (BCU, BKF, KKU), 218 (BCU, BKF, KKU)], Sakon Nakhon [Phu Phan, 6 Nov. 2004, *P. Traiperm* 155 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [Phu Khiao, 22 Feb. 1931, *A.F.G. Kerr* 20218 (BK)], Nakhon Ratchasima [Khao Yai National Park, Khao Khiao, 29 Aug. 1963, *T. Smitinand & H. Sleumer* 8321 (BKF, K, L)], Roi Et [Ban Wa Ngarm, Kaset Wisai, 9 Jun. 1982, *Y. Paisooksantivathana & S. Sutheesorn* y 978-82 (BK)], Si Sa Ket [Dongrak range, Chong Bat Lak, Kantharalak, 20 Aug. 1976, *J.F. Maxwell* 76-591 (AAU, BK, L)]; SOUTH-EASTERN: Prachin Buri [Watana, 27 Dec. 1923, *A.F.G. Kerr* 9783 (BK, BM, K)], Chanthaburi [25 Nov. 1970, *M. Larzarides* 7459 (BKF, C, K, L)], Trat [Khlong Yai, 25 Dec. 2005, *P. Traiperm* 351, (BCU, BKF, KKU)]; PENINSULAR: Satun [28 Dec. 1927, *A.F.G. Kerr* 13711 (BK, BM, K); Thung Nui, 2 Sept. 1961, *T. Smitinand* 7128 (BKF)].

Distribution.— Southeast Asia.

Ecology.— In open grassy pine forest or in open area, at 50-1,300 m altitude. Flowering in June to March.

Notes.— This is a very distinctive variety. The inflorescence is suffused with purple and covered with long white hairs.

2. Ischaemum hansenii Bor, Dansk Bot. Arkiv (23) 4: 470. 1968.— Type: Thailand, Trang, Ko Talibong, *B. Hansen & T. Smitinand* 12198 (holotype K!, isotypes BKF!, C!, L!).

Perennial. *Culms* 20–25 cm, creeping or somewhat prostrate, culm glabrous, node glabrous or ciliolate. *Leaf-sheaths* loose, 2–3 cm long, glabrous. *Ligules*, membranous with ciliate margin, 0.8–1 mm long, brownish. *Leaf-blades* lanceolate, 3-7 by 0.6–0.9 cm, acute at the apex, glabrous on both surfaces. *Inflorescences* racemes, terminal, 2.5–4.5 cm long, conjugate not separating into 2 racemes when mature, rachis internodes triangular-shaped, *ca.* 5 by 1 mm, pilose on keel, nodes with a ring of long cilia, callus *ca.* 1 mm long, glabrous. *Sessile spikelet*; lower glume elliptic, 5.5–6 by 2–2.5 mm, indurated below, 2-apical wings and along the upper margins, wings scabrous, glabrous on the back, folded, lower glume apex dentate; upper glume boat-shaped, *ca.* 7 by 1.2 mm, acuminate, keeled along the upper back, keeled scabrous, upper margins ciliate. *Lower floret*; lemma lanceolate, *ca.* 5 by 1 mm, upper margins folded, margins ciliate; lower elliptic, *ca.* 5 by 1 mm, margins

folded, upper margins long ciliate; upper lemma *ca.* 4.5 by 1 mm, bifid, awned from sinus, twisted column, 12–15 mm long, upper margins ciliate; palea lanceolate, *ca.* 5 by 0.8 mm, hyaline, slightly folded, margins ciliate. *Ovary* ellipsoid, *ca.* 1.5 mm long. *Pedicelled spikelets* laterally compressed. *Pedicels* triangular shaped, *ca.* 4 by 1 mm, pilose along keel. *Glumes*; lower glume oblique-lanceolate, plicate, *ca.* 6 by 1 mm, indurate and convex below, margins scabrous, wing on keel, keel scabrous, glabrous on the back; upper glume boat-shaped, *ca.* 6 by 1 mm, acuminate, keel along the upper back, keel scabrous, margins ciliate. *Lower floret*; lemma boat-shaped or ovate, *ca.* 5 by 1 mm, hyaline, upper margins ciliate; palea lanceolate, *ca.* 5 by 0.8 mm, hyaline, slightly folded, upper margins ciliate. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers* 3, *ca.* 2.5 mm long, yellow. *Upper floret*; lemma, *ca.* 4 by 1 mm, bifid, awned from sinus, twisted, 13–15 mm long, upper margins ciliate; palea lanceolate, *ca.* 4.5 by 0.8 mm, hyaline, slightly folded (Fig. 5.28A-C).

Thailand.— PENINSULAR: Trang [Ko Talibong, 10 Nov. 1966, *B. Hansen & T. Smitinand* 12198 (BKF, C, K, L)].

Distribution.— Endemic to Thailand.

Ecology.— Creeping on rocks by the sea, at sea level. Flowering in November.

Notes.— Known only from the type specimen. I can not be collected even in their original locality.

3. Ischaemum hirtum Hack. in DC. Monog. Phan 6.: 1889. 228.— Type: India, Khasia, *J.D. Hooker & T. Thomson* 1937 (holotype K!).

Annual, tufted. *Culms* erect, terete, 45–70 cm tall, nodes ciliate, internodes glabrous. *Leaf-sheaths* tight, 4–6 cm long, glabrous to pilose. *Ligules*, membranous, 1–2 mm long. *Leaf-blades* linear, 8–15 by 0.4–0.6 cm, pilose on both surfaces, margins scabrous, base tapering, acute at the apex. *Inflorescences* racemes, terminal and axillary, 4–6 cm long, separating into 2 racemes, rachis internodes oblong, triangular or quadrangular in transverse, 3–4 mm long, hairy along the angles, nodes with a ring of long cilia, hairs up to 3 mm long, callus 1–1.3 mm long. *Sessile spikelet*; lower glume 5–5.5 mm long, 9–10-nerved, pilose on the back, upper margins scabrous, expanded at base, marginals nerved prolonged form 2 points, narrowly

fringed wings along the upper margins; upper glume boat-shaped, 6.5–7 mm long, midnerve extended to long tail, scabrous wing along tail, glabrous on the back, upper margins ciliate. *Lower floret*; lemma *ca.* 5 mm long, plicate, scabrous along marginal keel; palea *ca.* 5 mm long, hyaline, slightly folded, upper margins ciliate. *Lodicules ca.* 0.5 mm long. *Anthers* yellow, *ca.* 2 mm long. *Upper floret*; lemmas boat-shaped, *ca.* 5 mm long, hyaline, bifid, twisted awn from sinus, 8–10 mm long; palea lanceolate, *ca.* 5 mm long, hyaline, slightly folded, upper margins ciliate. *Ovary* narrowly ovate, 1.5–2 mm long. *Pedicelled spikelets*; pedicels triangular, 3–4 mm long, hairy along the angles. *Glumes*; lower glume plicate, 5–5.5 mm long, scabrous wing along keel, pilose, upper margins ciliate; upper glume folded, 5.5–6 mm long, keeled along mid-nerved and prolonged in to long tail, upper margins ciliate. *Lower floret*; lemma *ca.* 5 mm long, hyaline, folded, upper margins ciliate; palea 4.5–5 mm long, hyaline, folded, upper margins ciliate. *Anthers* yellow, *ca.* 2 mm long. *Upper floret*; lemma *ca.* 4 mm long, bifid, hyaline, folded, twisted awn from sinus, 7–10 mm long; palea narrow, *ca.* 5 mm long, apex with tail, scabrous, hyaline (Fig. 5.28D-F).

Thailand.— NORTH-EASTERN: Phetchabun [Nam Nao National Park, 20 Nov. 2004, *P. Traiperm* 171 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [Nam Phrom, 10 Dec. 1971, *C.F. van Beusekom et al.* 4069 (BKF, C, K, L, P);], Nakhon Ratchasima [Dan Chumpon, 21 Dec. 1929, *A.F.G. Kerr* 17653 (BM, K)]; PENINSULAR: Ranong [Khao Paw Ta Luang Kaew, 10 Dec. 1979, *T. Shimizu et al.* T-26890 (L)].

Distribution.— India and Thailand.

Ecology.— Along river banks or near stream, at 50-1300 m altitude. Flowering between November and December.

Notes.— The distribution has a curious disjunction between India and Thailand. This species should occur somewhere in upper Myanmar. However, there still scanty available taxonomic data of this plant group from this country.

4. Ischaemum hubbardii Bor in Indian Forest Rec., n.s. Bot. 1: 98. 1938.— Type: India: Assam, fairly common in the Khasia and Jaintia hills, alt. 4,000-5,000 m, *N.L. Bor* 2264 (holotype K!).

Perennial, densely tussocking grass. *Culms* slender, terete, 25–60 cm tall, internodes and nodes glabrous. *Leaf-sheaths* tight, 4–7 cm long, glabrous or slightly pilose, margins thin. *Ligules*, long membranous 3.5–5 mm long, glabrous. *Leaf-blades* lanceolate, 5–15 by 0.3–1 cm, tuberculate pilose on both surfaces, margins scabrous, apex acute. *Inflorescences* raceme, terminal, 3–5 cm long, conjugated with 2 racemes, rachis internodes oblong 6–6.5 by *ca.* 0.1 mm, triangular in transverse section, pilose along central keel, nodes with a ring of long cilia, callus *ca.* 1 mm long, glabrous. *Sessile spikelet*; lower glume oblong, 6.5–8 by 1.5–1.8 mm, distinctly 10–14-nerved, subcoriaceous, transverse humped along the lower 1/3, glabrous on back, unequally narrowly laterally winged above, wing scabrous; upper glume boat-shaped, 8–9 mm by 1.8-2.2 mm, keeled, scabrous, margins ciliate, apex acuminate, with a small wing at the apex. *Lower floret*; lemma lanceolate, 7–7.5 by *ca.* 1.5 mm, hyaline, slightly folded, upper margins ciliate; palea elliptic, 5.5–6 by *ca.* 1.5 mm, hyaline, folded, apex muticous. *Upper floret*; lemmas *ca.* 7 mm long, bifid, geniculately awned from sinus, awn twisted, 18–25 mm; palea ovate, *ca.* 5 by 1.3 mm, apex acute, hyaline. *Lodicules* cuneate, 1–1.2 mm long. *Pedicelled spikelets*; pedicels 5.5–6 by *ca.* 1 mm, pilose along central keel. *Glumes*; lower glume obliquely-oblong, 7–7.5 by 2.7-3 mm, 6–8-nerved, with 2 subequal wings along whole length of the margins, glabrous on back, margins folded, apex bifid; upper glume boat-shaped, 7–8 by 1.5 mm, keeled along the upper of mid-nerve, scabrous on keel. *Lower floret*; lemma lanceolate, *ca.* 6 by 1.2 mm, hyaline, folded, glabrous, apex acute; palea oblong, *ca.* 5 by 0.8 mm, apex acute, hyaline, slightly folded. *Anthers ca.* 3 mm long. *Upper floret*; lemma ovate, *ca.* 5.5-6.5 by 0.9-1.4 mm, apex acute, hyaline, folded; palea oblong, *ca.* 4.5-6 by 0.8-1.2 mm, apex rounded, hyaline, slightly folded. *Caryopsis* ellipsoid, *ca.* 3 mm long (Figs. 5.2 & 5.29A. & B).

Thailand.— NORTHERN: Chiang Mai [Kio Mae Pan nature trail, Doi Inthanon, 25 Nov. 2005, *P. Traiperm* 308 (BCU, BKF, KKU); 3 Oct. 2001, *S. Laegaard & M. Norsangsri* 21669 (AAU, K, L); Doi Inthanon National Park, along road from summit *ca.* 5 km towards entrance, 16 Oct. 2001, *S. Laegaard & M. Norsangsri* 21728 (AAU)].

Distribution.— India.

Ecology.— Common along Kio Mae Pan nature trail or in lawn near pagoda, alt. 1,950-2,350 m. Flowering between October and November.

Notes.— *I. hubbardii* is characterized by its tuberculate-pilose leaves together with a lower glume that has 10–14 distinct nerves, and transverse hump on the lower 1/3 of the glume, which is glabrous on the back. It is similar to *I. indicum* (Houtt.) Merr. in having glabrous surface on the back of the lower glume of sessile spikelets but differs in having the unequal narrowly lateral wings above and hairs on both surfaces of the leaf-blades. The lower glume of the sessile spikelet in the Thai specimens has a transverse, nearly flat hump on the lower 1/3 of the glume whereas the hump is slightly convex on the back of the type specimen from India.

5. Ischaemum indicum (Houtt.) Merr., J. Arn. Arbor. 19: 320. 1938.

Phleum indicum Houtt., Nat. Hist. 2 (13): 198. 1782.

Perennial, rhizomatous. *Culms* slender, erect, up to 1 m tall, rooting at the lower nodes, internodes glabrous, terete, nodes pilose. *Leaf-sheaths* nearly tight, 5-11 cm long, glabrous but pilose or with tubercle-based hairs at margins especially near ligule or rarely pubescent on surface. *Ligules* membranous, 1–2 mm long. *Leaf-blades* 7–25 by 0.4–1.2 cm, pilose or pubescent on both surfaces, margins scabrous, base rounded, sometimes abruptly narrow. *Inflorescences* digitate, separating into 2 racemes or v-shaped, terminal, 4–9 cm long, rachis internodes oblong, pilose along the angles, nodes hirsute; callus 1.5–2 mm long, at base. *Sessile spikelet*; lower glume oblong, 4–6 mm long, many nerved, coriaceous, indurate and expanded below, upper foliose, bifid, distintly 2-apical winged at the apex, sometimes lateral nerve prolonged form short caudate, glabrous on the back, margins folded; upper glume boat-shaped, 6–8 mm long, scabrous winged on keel, 5-nerved, midnerved prolonged form tail, glabrous on the back, sometimes pilose, margins folded, upper margins ciliate. *Lower floret*; lemma 4–5 mm long, hyaline, folded; paleas 4–5 mm long, plicate, margins ciliate. *Upper floret*; lemma folded, 4–4.5 mm long, hyaline, bifid, geniculately awned from sinus, awn twisted, 15–18 mm long, margins ciliate; palea lanceolate, 3.5–4 mm long, plicate, 2-nerved, hyaline. *Pedicelled spikelets* laterally compressed. *Pedicels* rachis internode like but shorter. *Glumes*; lower glume 4–6 mm long, folded, scabrous winged on keel, apex short caudate, glabrous on the back or pilose; upper glume boat-shaped, 4–6.5, mm long, short tail, margins long ciliate, pilose on the back, winged on keel. *Lower florets* and upper florets same as the sessile spikelet (Fig. 5.29C-E).

Thailand.— NORTHERN: Mae Hong Son [Doi Mae Yae, Pai, 11 Mar. 1999, *P. Suksathan* 2036 (QBG); Doi Pui, 20 Oct. 1999, *P. Suksathan* 1958 (QBG)], Chiang Mai [Mae Wang, 27 Feb. 1993, *J.F. Maxwell* 93-209 (L); Mae Jam, Den (Karen) Village, Ban Wat Chan, 12 Apr. 1998, *J.F. Maxwell* 98-1405 (BKF); Mae Rim, 8 Nov. 1994, *M. Norsangsri* s.n. (QBG); 10 Feb. 1995, *M. Norsangsri* 738 (QBG); 16 Nov. 1996, *M. Norsangsri* s.n. (QBG); 11 Apr. 1999, *M. Norsangsri* 910 (QBG); 21 Nov. 1996, *BGO. Staff* 7874 (QBG); Hang Dong, 25 Nov. 2005, *P. Traiperm* 309 (BCU, BKF, KKU)], Chiang Rai [Khun Korn waterfalls, 1 Dec. 2005, *P. Traiperm* 317 (BCU, BKF, KKU)], Nan [Pua: W side of Phu Kha National Park, near forest station, 21 Nov. 1993, *K. Larsen et al.* 44716 (AAU); Doi Phu Waae, 14 Nov. 2000, *P. Srisanga* 1905 (QBG)], Uttaradit [Phu Soi Dao National Park, 28 Oct. 1998, *H.J. Esser* 982-238 (L)], Tak [Mae Ra Mad, 21 Nov. 1989, *Y. Paisooksantivathana* y 2528-89 (BK)], Sukhothai [Khao Luang National Park, 16 Dec. 2005, *P. Traiperm* 330 (BCU, BKF, KKU), 331 (BCU, BKF, KKU), 332 (BCU, BKF, KKU), 333 (BCU, BKF, KKU), 334 (BCU, BKF, KKU), 335 (BCU, BKF, KKU), 336 (BCU, BKF, KKU); 17 Dec. 2005, *P. Traiperm* 337 (BCU, BKF, KKU), 338 (BCU, BKF, KKU), 340 (BCU, BKF, KKU), 341 (BCU, BKF, KKU), 342 (BCU, BKF, KKU)], Nakhon Sawan [Hua Wai, 29 Nov. 1828, *Put* 2170 (BKF, BM, K); roadside on mt. slope Wat Par Devastaporn, 4 Dec. 1957, *J. Santose* 6681 (L)]; NORTH-EASTERN: Loei [1 Oct. 1952, *Dee* 616 (BKF, K); Phu Luang, Nam Thop, 18 Nov. 1968, *C. Chermsirivathana* 1163 (BK); Phu Kradueng, 17 Sept. 1954, *T. Smitinand* 1935 (BKF); *Ch. Charoenphol et al.* 4618 (AAU, BKF, K); 18 Aug. 1958, *T. Smitinand* 1845 (BKF); 31 Oct. 1984, *S. Mitsuta et al.* T-42284 (BKF, L); 12 Nov. 2004, *P. Traiperm* 157 (BCU, BKF, KKU), 160 (BCU, BKF, KKU); 13 Nov. 2004, *P. Traiperm* 165 (BCU, BKF, KKU), 166 (BCU, BKF, KKU); 29 Oct. 2005, *P. Traiperm* 257 (BCU, BKF, KKU), 258 (BCU, BKF, KKU), 259 (BCU, BKF, KKU); 31 Oct. 2005, *P. Traiperm* 271 (BCU, BKF, KKU); Tham Yai water falls to Phen Phop water fall, Phu Kradueng, 9 Feb. 1988, *H. Koyama* T-61517 (BKF); on the way to Pha Makdook, 5 Sept. 1988, *H. Koyama* T-61569 (AAU, BKF); Na Haew, 10 Mar. 1995, *M. Norsangsri* 763 (QBG); Phu Ruea, 4 Dec. 2004, *P. Traiperm* 189 (BCU, BKF, KKU), 191(BCU, BKF, KKU), 192 (BCU, BKF, KKU), 195 (BCU, BKF, KKU); 6 Dec. 2004, *P. Traiperm* 196 (BCU, BKF, KKU), 197 (BCU, BKF, KKU)], Nong Khai [Phu Woa, 16 Oct. 2005, *P. Traiperm* 219 (BCU, BKF, KKU)], Khon Kaen [Phu Wiang National Park, 5 Nov. 1996, *BGO. Staff.* 6490 (QBG)]; EASTERN:

Chaiyaphum [Thungkamang, 15 Dec. 1971, *C.F. van Beusekom et al.* 4291 (K, L); Phu Khiao, 27 Nov. 2004, *P. Traiperm* 180; 19 Oct. 2005, 220 (BCU, BKF, KKU); Tat Tone, 1 Jan. 2006, *P. Traiperm* 369 (BCU, BKF, KKU)], Roi Et [km 25 on road 208 E of Roi Et, 26 Oct. 2001, *S. Laegaard et al.* 21806 (AAU); Suwannaphum, 22 Oct. 2005, *P. Traiperm* 230 (BCU, BKF, KKU)], Ubon Ratchathani [km 36 on road 217 E of Warin Chamrap, 27 Oct. 2001, *S. Laegaard et al.* 21810 (AAU, L); km 10 on road 2112 to Khong Chiam, 23 Oct. 2005, *P. Traiperm* 251 (BCU, BKF, KKU)]; SOUTH-WESTERN: Kanchanaburi [Kwae Noi River Basin, near Neckey, near Wangka, 18 Apr. 1946, *G. den Hoed* 590 (K)], Prachuap Khiri Khan [Khao Luang, 5 Jul. 1926, *A.F.G. Kerr* 10859 (BK); Cha-um, 15 Apr. 1960, *C. Chermsirivathana* s.n. (BKF)]; CENTRAL: Nakhon Nayok [Nang Rong, 24 Nov. 1957, *J. Santose* 6670 (L); 5 Nov. 2005, *P. Traiperm* 278 (BCU, BKF, KKU)], Krung Thep Maha Nakhon [28 Oct. 1923, *A.F.G. Kerr* 7937 (BK)]; SOUTH-EASTERN: Chanthaburi [Klung, 30 Dec. 1924, *A.F.G. Kerr* 9538 (BM, K); Makham, Khao Klua, 24 Nov. 1956, *T. Smitinand* 3622 (BKF); 19 Nov. 2005, *P. Traiperm* 289 (BCU, BKF, KKU); foot of Khao Soi Dao; 12 Nov. 1969, *C.F. van Beusekom & T. Smitinand* 2149 (AAU, C, E, L); Taluang, 21 Dec. 1994, *A.F.G. Kerr* 9731 (BK); 17 Oct. 2004, *J.F. Maxwell* 71-337 (BKF)], Trat [Dan Chumpon, 21 Dec. 1929, *A.F.G. Kerr* 17653 (BK, BM, K)]; PENINSULAR: Chumphon [27 Jan. 1927, *A.F.G. Kerr* 11647 (K)], Ranong [Kra Buri, 25 Dec. 1928, *A.F.G. Kerr* 16367 (BK, BM, K); Ngaow, 26 Oct. 2004, *P. Traiperm* 147 (BCU, BKF, KKU)], Phangnga [Nop Pring, 6 Mar. 1930, *A.F.G. Kerr* 18396 (BK); Thai Mueang, 19 Feb. 1971, *J. Sadakorn* 232, 19 Feb. 1971 (BK); 24 Oct. 2004, *P. Traiperm* 144 (BCU, BKF, KKU), 145 (BCU, BKF, KKU); Takua Pa, 24 Oct. 2004. *P. Traiperm* 146 (BCU, BKF, KKU); Takua Thung, Tongland plantation, 30 Nov. 1986, *J. Supapol* 103 (CMU, PSU)], Krabi [Phanom Bencha, 28 Mar. 1930, *A.F.G. Kerr* 18716 (BM)], Satun [28 Dec. 1927, *A.F.G. Kerr* 13711A (BK, K); Tah Pae, 14 Nov. 1986, *J.F. Maxwell* 86-918 (BKF, CMU, L, P, PSU].

Distribution.— India to Japan, S to Malaysia, Australia.

Ecology.— Lawns, roadsides, open places, paddy fields or wet places up to 1,950 m altitude. Flowering between September and April.

Notes.— The extreme variations of hairiness and apical wings in lower glume of the sessile spikelet are certainly distinct; however, they are connected by a complete series of intermediates. It seems better not to divide this species into a

number of microspecies, but to wait until a monographic study of the whole genus should finally clear the difficulties.

6. Ischaemum lacei Stapf ex Bor, Kew Bull. 4: 187. 1950.— Type: Burma, Amherst, Daiona Range, Muleyit Peak, 27 Jan. 1912, *J.H. Lace* 5627 (lectotype K!, selected here).

Perennial. *Culms* slender, erect, up to 1 m tall, rooting at the lower nodes, internodes glabrous, terete, nodes ciliate. *Leaf-sheaths* nearly tight, 3.5–6 cm long, pilose with tubercle- based hairs. *Ligules* membranous, 1.5–2 mm long. *Leaf-blades* lanceolate, 5–14 by 0.7–1.2 cm, pilose with tubercle-based hairs on both surfaces, margins scabrous, base rounded. *Inflorescences* digitate, separating into 2 racemes or V-shaped, terminal, 3–7 cm long, rachis internodes oblong, pilose along the angles, nodes hirsute; callus 0.5–1 mm long, at base. *Sessile spikelet*; lower glume oblong, 4–4.5 mm long, coriaceous, indurate and expanded below, upper foliose, pilose on the upper back, margins folded, apex bifid, 2-obliquely narrowly lateral winged above, wing scabrous or sometime wingless; upper glume boat-shaped, 6–6.5 mm long, scabrous winged on keel, glabrous on the back, apex slightly caudate. *Lower floret*; lemma oblong, 5.5–6 mm long, hyaline, upper margins ciliate; palea 5–5.5 mm long, hyaline, margins folded and ciliate. *Upper floret* lemma 4.5–5 mm long, hyaline, margins ciliate, apex bifid, geniculately awned from sinus, awn twisted, 11–12 mm long; upper palea lanceolate, 4.5–5 mm long, hyaline. *Pedicelled spikelets* laterally compressed. *Pedicels* look-like rachis internode. *Glumes*; lower glume 4.5–5 mm long, margins folded, expanded at base, scabrous winged on keeled, apex acute, slightly pilose on the back; upper glume boat-shaped, 5.5–6.5 mm long, margins folded, slightly pilose on the above. *Lower florets* and upper florets same as sessile spikelet (Fig. 5.30A. & B).

Thailand.— NORTHERN: Chiang Mai [Doi Nang Ka, 4 Nov. 1930, *Put* 3356 (BK, BM, K)].

Distribution.— India to Burma.

Ecology.— Not recorded. Flowering in November.

Notes.— This species differs from *I. hubbardii* in having smooth lower glume of the sessile spikelet, while the lower glume of *I. hubbardii* coarsely ridge with nodules along the margins.

The original description cited the collection of *J.H. Lace* 5627 and *R.N. Parker* s.n.. Therefore, *J.H. Lace* 5627 kept at K is selected as the lectotype because it is the best preserved specimen.

7. Ischaemum magnum Rendle, J. Bot. 32. 102. 1894.— Type: Singapore, Blakan Mate, October 1892, *J.B. Feilding* s.n. (lectotype BM!, selected here, isolectotype K!).

I. leave Ridl., J. As. Soc. Straits 44: 207. 1905.— Type: Singapore, Galang, *Ridley* 9143 (isotype K!).

Perennial, tufted. *Culms* erect, robust, up to 2 m tall, nodes and internodes glabrous. *Leaf-sheaths* loose, 11–14 cm long, glabrous. *Ligules* membranous *ca.* 1 mm long. *Leaf-blades* lanceolate-acute, 13–40 cm by 1.3–3 mm, glabrous on both surfaces, margins scabrous, base cordate. *Inflorescences* composed of racemes, digitate racemes, 2–4 racemes, 9–15 cm long, rachis internodes clavate, *ca.* 8.5 by 2 mm, glabrous, callus cupuliform, *ca.* 1 mm long, glabrous. *Sessile spikelet*; lower glume oblong on the lower part, upper part obiquely foliose 10–11 by *ca.* 2 mm, margins folded, glabrous on the back, acute at the apex, slightly winged along the upper margins, wing scabrous; upper glume boat-shaped, 9–10 by *ca.* 1.5 mm, scabrous along margins, keeled on the back, apex acute. *Lower floret*; lemma slightly boat-shaped, 8.5–9 mm long, hyaline, margins folded, scabrous along upper margins, apex acute; palea 8–8.5 mm long, hyaline, margins folded, scabrous along margins and apex. *Upper floret*; lemma *ca.* 7 by 0.8 mm, hyaline, slightly folded; palea boat-shaped, 9–9.5 by *ca.* 1.5 mm, hyaline, margins ciliate, acuminate. *Ovary* elliptic, *ca.* 2 mm long. *Pedicelled spikelet*; pedicels glume *ca.* 10 by 2.5 mm, with 2 subequal wings, longer wing along margins, margins scabrous, the smaller wing only on the apex, glabrous on the back; upper glume boat-shaped or lanceolate, 9–9.5 by 1.8 mm, keeled along the back, scabrous along keel, apex acute. *Lower floret*; lemma lanceolate, *ca.* 9 by 2 mm, hyaline, folded, glabrous; palea elliptic, *ca.* 8 by 1.2 mm, hyaline, folded, acute. *Upper floret*; lemma linear, *ca.* 6.5 by 0.5 mm, hyaline folded; palea linear-lanceolate, *ca.* 8.5 by 1 mm, hyaline, folded, acute (Fig. 5.30C-E).

Thailand.— CENTRAL: Saraburi [Sam Lan forest, Mueang, 8 Sept. 1974, *J.F. Maxwell* 74-898 (BK, L)], Krung Thep Maha Nakhon [15 Oct. 1922, *A. Marcan* 1024 (BM); 7 Oct. 1923, *A.F.G. Kerr* 7858A (BK, BM, K); 18 Oct. 1923, *A.F.G. Kerr* 7930 (K); 30 Sept. 1923, *A.F.G. Kerr* 7858 (BK, BM, K); 28 Oct. 1928, *A.F.G. Kerr* s.n. (BK, BM); 2 Nov. 1924, *A. Marcan* 1831 (BM); 2 Nov. 1924, *A.F.G. Kerr* 9351 (BK, BM, K); Bang Khen, 10 Apr. 1958, *T. Smitinand* 5398 (BKF)]; PENINSULAR: Trang [Kuan Pring Research Station, 21 Nov. 1986, *J. Supapol* 47 (CMU)]; Satun [Tarutao, 18 Feb. 1979, *J.F. Maxwell* 280 (PSU)], Songkhla [Thepa, 30 Oct. 1986, *P. Atchariyapanya & J. Supapol* 47 (CMU, PSU)].

Distribution.— Burma to Borneo.

Ecology.— Margin of rivers, canals and lakes, 0-280 m altitude. Flowering in September to May.

Notes.— *Ischaemum magnum* is similar to *I. barbatum*, but differs in having no awn while the distinctly awns in *I. barbatum*. For the type of *I. magnum*, the original description referred to the collection *J.B. Feilding* s.n.. A duplicate deposited at BM is selected as the lectotype because it is the best preserved specimen.

8. Ischaemum muticum L., Sp. Pl.: 1049. 1753.— Type: *Herb. Linn.* 1214.1 (lectotype LINN!).

Rottboellia brevis Chauvin ex Steud. Syn., Pl. Glumac. 1: 361. 1855.— Type: *Steudel* s.n. (holotype P!).

Perennial. *Culms* stoloniferous, long-creeping, stolon internodes up to 10 cm, erect, glabrous. *Leaf-sheaths* loose, 2–3 mm long, glabrous to slightly pilose, ciliate along margins. *Ligules* membranous, *ca.* 1 mm long, pale brown. *Leaf-blades* linear to linear-lanceolate, 2.5–6 by 4–8 mm, glabrous above, strigrillose along their margins, slightly cordate to rounded at the base, acuminate at the apex. *Inflorescences* racemes, terminal, exserted with two closely appressed racemes, 2.5–3.5 cm long. *Sessile spikelet*; lower glume ovate, 7–7.5 by *ca.* 3 mm, coriaceous, yellowish, glabrous, winged above the middle; upper glume boat-shaped or ovate, 7–8 by *ca.* 2.5 mm, keeled in the upper half, glabrous, fringed on the upper margins, apex acute. *Lower floret* staminate; lemma ovate-acute, 6–6.5 mm long, 3-nerved, hyaline, hairy above margins; palea 6–6.5 mm long, subcoriaceous, enfolded, 2-fringe keeled on both margins. *Anther ca.* 3 mm long, yellow. *Stigmas* whitish. *Upper floret* hermaphrodite;

lemma ovate, *ca.* 7 mm long, subcoriaceous, enfolded, bifid at the tip, awnless, fringe on marginal winged; palea *ca.* 6 mm long, hyaline, margins narrowly inflexed in the upper part. *Anthers ca.* 3 mm long, yellow. *Stigmas* whitish. *Pedicelled spikelet*; pedicels *ca.* 5 mm long, similar in structure and pubescence to the rachis. *Glumes*; lower glume ovate-acute, *ca.* 6 mm long, subcoriaceous, enfolded, glabrous; upper glume ovate or boat-shaped, subchartaceous, asymmetrically, 1-fringe keeled on the upper part, enfolded, glabrous, apex acute. *Lower floret* staminate; lemma *ca.* 6 mm long, chartaceous, enfolded, glabrous 2-winged above; palea ovate-acute, 5.5–6 mm long, subchartaceous, enfolded. *Anthers* 2.5–3 mm long, yellow. *Stigmas* whitish. *Upper floret* hermaphrodite; lemma narrowly ovate-acute, *ca.* 6 mm long, hyaline, enfolded; palea linear, *ca.* 5 mm long, hyaline. *Lodicules* truncate. *Anthers* 2.5–3 mm long, yellow. *Stigmas* whitish (Fig. 5.31A. & B).

Thailand.— SOUTH-EASTERN: Chon Buri [Sattahip, 6 Apr. 1971, *J.F. Maxwell* 71-294 (AAU, BK, L)], Rayong [Ban Pae, 27 Nov. 1964, *S. Sutheesorn* 234 (BK); Klang, 26 Sept. 1965, *C. Chermsirivathana* 384 (BK); 22 Aug. 1977, *C. Phengklai et al.* 3802 (BKF); Koh Samet, 18 Mar. 1970, *C.F. van Beusekom & T. Santisook* 3246 (AAU, C, E, K, L, P); 12 km E of Ban Phae, 23 Sept. 1990, *P. Chantaranothai et al.* 90/348 (AAU, K); Laem Son, 20 Nov. 2005, *P. Traiperm* 294 (BCU, BKF, KKU)], Chanthaburi [Laem Sing, 8 Apr. 1923, *A. Marcan* 1345 (BM); *A.F.G. Kerr* 6941 (BK, BM, K); 10 Sept. 1964, *Adisai* 858 (BK)], Trat [19 Jan. 1927, *Put* 500 (BK, BM, K); Koh Kut, *C. Phengklai* 13020 (BKF), 13600 (BKF); Koh Chang, 1 Oct. 1924, *A.F.G. Kerr* 9274 (K); 17 Nov. 1970, *Ch. Charoenphol et al.* 4940 (AAU, C, E, K, P); road near port, 25 Mar. 2001, *K. Chayamarit et al. 2928* (BKF); 9 Jun. 1925, *Rabil* 67 (BK, BM, K); 26 Feb. 1955, *T. Smitinand* 2311 (K); 4 Apr. 1959, *Th. Sørensen et al.* 7166 (C, K); 24 Dec. 2005, *P. Traiperm* 350 (BCU, BKF, KKU)]; PENINSULAR: Chumphon [Pak Nam Chumpon, 15 Feb. 1968, *Vacharapong* 024, (BK); Lang Suan, 5 Jun. 1969, *Jaray* 129 (BK)], Ranong [Ban Keow, 5 Aug. 1973, *R. Geesink & C. Phengklai* 6343 (AAU, C, E, L)], Surat Thani [Koh Tao, 1 Jan. 1927, *A.F.G. Kerr* 11226 (BK, BM, K); 30 Dec. 1926, *A.F.G. Kerr* 11184 (BK, BM, E, K, L); Ban Wat Hmai, Samhui, 29 Aug. 1983, *C.A.* 42 (PSU); Prunseeng, Chaiya, 29 May 1960, *Chirayupin* 105 (BK); Koh Samui, Feb. 1995, *T.B. Ryves*, KS95/016 (K)], Phangnga [Koh Tachai, *C. Phengklai* 12813 (BKF); 4 Apr. 1999, *Th. Wongprasert* s.n. (BKF)], Phuket [*C. Phengklai et al.* 15,277 (AAU);

Thalang, 13 Aug. 1965, *T. Smitinand* 8910 (BKF); under Sarasin bridge, 23 Jul. 1968, *C. Chermsirivathana* 980 (BK); Mueang, 2 Jul. 1979, *T. Koyama et al.* 15,299 (BKF)], Krabi [Banklongrad, Khlong Thom, 29 Nov. 1986, *J. Supapol* 184 (CMU, PSU); Lan Ta National Park, 1 Jul. 1992, *C. Niyomdham* 2851 (BKF)], Satun [Tarutao, 20 Apr. 1969, *C. Chermsirivathana & Kasem* 1427 (BK); 18 Feb. 1979, *G. Congdon* 282 (AAU, PSU); 31 Jan. 1980, *G. Congdon* 313 (AAU, PSU), 429 (AAU, PSU); 5 Apr. 2005, *P. Traiperm* 199 (BCU, BKF, KKU); 20 May 2005, *P. Traiperm* 213 (BCU, BKF, KKU)], Songkhla [Pattani road, 55 km form Songkhla, 31 Oct. 1990, *K. Larsen et al.* 41020 (AAU, PSU); Mueang, beach, 13 Feb. 1999, *P. Buapet* 2 (PSU); 19 Oct. 2004, *P. Traiperm* 138 (BCU, BKF, KKU); Banthom, Lake Songkhla, 19 Aug. 1983, *W. Eddie* 54 (PSU)], Narathiwat [Paa Wai, Su Ngai Paa Dee, 31 Aug. 1988, *C. Niyomdham & W. Ueachirakan* 1919 (AAU, BKF, C, E, K, L, P)].

Distribution.— Worldwide.

Ecology.— Creeping grass, common along road to seashore, at sea level. Flowering throughout the year.

Vernacular.— Ya wai tham (หญ้าไหวทาม) (Trat).

Notes.— It is readily distinguished from the other species of *Ischaemum* by the short inflorescence with whitish stigmas sticking out laterally and awnless upper lemma.

9. Ischaemum rugosum Salisb., Icon. Stirp. Rar.: 1, t.1. 1791.— Type: India, Orissa, *Koenig* s.n. (holotype BM!, isotype K!).

Annual, tufted, caepitose. *Culms* usually erect somewhat prostrate, 30–120 cm tall, culm glabrous, ciliolate at node. *Leaf-sheaths* loose, 10-12 cm long, pilose hairs 1–1.5 mm long. *Ligules* membranous, 3–3.5 mm long, brownish. *Leaf-blades* lanceolate, 10–30 by 1–1.3 cm, lower blades narrowed gradually to the base, upper blades abruptly rounded, margins scabrous, surface pilose, base densely hairy, acuminate at the apex. *Inflorescences* racemes, terminal, 6–10 cm long, conjugate when young, and separating into 2 racemes when mature, rachis internodes 3.5–4.5 mm long, fragile, thickened upwards, long pilose on the central keel, nodes with a ring of long cilia, callus short, *ca.* 0.8 mm long, glabrous. *Sessile spikelet* oblong-ovate, 5 mm long. *Glumes*; lower glume oblong-ovate, 5–5.5 by 2–2.5 mm, indurated

and coarsely ridged with 4–7 ridges for the lower part, many nerved above and margins narrowly inflexed, keeled towards the asymmetric apex, 2-obliquely lateral winged at the apex, ciliolate rounded at the apex; upper glume narrowly ovate, 4.5–5 mm long, keeled along the back with a hump slightly above the middle, margins ciliolated on the upper part, apex acute. *Lower floret*; lemma elliptic, *ca.* 4.5 by 1 mm, hyaline slightly folded, margins scabrous, apex muticous; palea narrowly ovate, *ca.* 4.5 by 1 mm, hyaline, folded, margins ciliate, apex acute. *Ovary* elliptic, *ca.* 2 mm long. *Upper floret*; lemmas narrow, *ca.* 4 mm long, bifid, geniculately awned from sinus, awn twisted, 15–20 mm; palea ovate-acute, *ca.* 3.5 by 0.8 mm, hyaline, upper margins scabrous. *Pedicelled spikelets*; pedicels triangular, *ca.* 1.5 mm long, pilose along keel. *Glumes*; lower glume oblique-ovate, *ca.* 2–5 by 2 mm, indurate below, upper foliose and many nerved, subequal winged along margins, wings scabrous, 2–3 transverse nodule at each edge; upper glume boat-shaped, *ca.* 5 by 1 mm, keeled along the back, keel scabrous, lower margins entire, upper margins scabrous, apex acute. *Lower floret*; lemma lanceolate, *ca.* 4.5 by 1 mm, hyaline, folded, glabrous, apex acute; palea elliptic-acute, *ca.* 3.5 by 0.8 mm, hyaline, folded. *Upper floret*; lemma linear, *ca.* 3.5 by 0.5 mm, hyaline, slightly folded, awned from the apex, awn scabrous, *ca.* 4 mm long; palea elliptic-muticous, *ca.* 2 by 0.7 mm, hyaline, slightly folded. *Caryopsis* ellipsoid, *ca.* 2 mm long (Fig. 5.31C-E).

Thailand.— NORTHERN: Mae Hong Son [Ban Na Pa Pak, 21 Oct. 1999, *P. Suksathan* 1974 (QBG)], Chiang Mai [Doi Inthanon, en route from Pha Mawn (Ban Yang) to the camp, 10 Feb. 1971, *G. Murata et al.* T-15882 (BKF), T-15888 (BKF); around Wachira water falls, 12 Jun. 1984, *G. Murata et al.* T-39945 (BKF); along road to Doi Inthanon, near visitor center 1-2 km inside park, 15 Oct. 2001, *S. Laegaard & M. Norsaengsri* 21721 (AAU, L); San Pa Tong, Mae Win, 10 Nov. 1980, *Y. Paisooksantivatthana* y 392 A-80 (BK); Mae Rim, 10 Apr. 1994, *M. Norsangsri* 803 (QBG); 11 Feb. 1995, *BGO. Staff* 5062 (QBG); 16 Nov. 1996, *M. Norsangsri* s.n. (QBG); 21 Nov. 1996, *BGO. Staff* 7866 (QBG); Wiang Hang-Ka Noi, 16 Jan. 2001, *M. Norsangsri* 1228 (QBG)], Phrae [Long, Tao Poon, 27 Nov. 1986, *Y. Paisooksantivatthana* y1934-86 (BK); Hot, 23 Nov. 2005, *P. Traiperm* 301 (BCU, BKF, KKU)], Uttaradit [Pichai, Ban Bak Klong, 20 Oct. 1992, *J.F. Maxwell* 92-635 (AAU, L, P)], Nakhon Sawan [Nong Bone, 12 Jan. 1982, *Y. Paisooksantivatthana* y779-82 (BK)]; NORTH-EASTERN: Loei [Sithan, 17 Oct. 1955, *T. Smitinand* 3047

(BKF, K); Nong Hin, 23 Nov. 1963, *Pradit* 729 (BK); Ban Nah Awe, Mueang, 11 Mar. 1993, *J.F. Maxwell* 93-243 (L)], Udon Thani [Ban Phue, 18 Nov. 1963, *Pradit* 676 (BK)], Nong Khai [Nong Song Hong, Pak Pree, 15 Nov. 1964, *S. Sutheesorn* 129 (BK)], Kalasin [near border of Sakhon Nakhon and Kalasin, along route 213, 12 Nov. 1984, *G. Murata et al.* T-51335 (BKF)], Maha Sarakham [Chiang Yuen, 6 Oct. 2004, *P. Traiperm* 127 (BCU, BKF, KKU)], Khon Kaen [Nam Phong, 7 Oct. 2005, *P. Traiperm* 212 (BCU, BKF, KKU)]; EASTERN: Roi Et [Suwannaphum, 22 Oct. 2005, *P. Traiperm* 231 (BCU, BKF, KKU)], Ubon Ratchathani [Lam Don Noi, 4 Dec. 1968, *T. Smitinand & J. Tunbang* 10496 (BKF)]; SOUTH-WESTERN: Kanchanaburi [Ban Kao, 12 Nov. 1961, *K. Larsen* 8158 (C, K); Erawan National Park, 19 Nov. 1971, *C.F. van Beusekom et al.* 3873 (BKF, C, K, P)], Prachuap Khiri Khan [Cha-um, 15 Apr. 1960, *C. Chermsirivathana* s.n. (BK)]; CENTRAL: Chai Nat [*Y. Paisooksantivatthana* s.n. (BK)], Ang Thong [29 Dec. 1929, *Put* 2588 (BK, BM, K); 11 Dec. 1971, *J.F. Maxwell* 71-782 (AAU, BK)], Saraburi [Sam Lan forest, Mueang, 14 Dec. 1974, *J.F. Maxwell* 74-1042 (AAU, BK, L)], Krung Thep Maha Nakhon [24 Dec. 1922, *A.F.G. Kerr* 6729 (BK, K); Pakret, 14 Oct. 1923, *A. Marcan 1495* (BM); 14 Oct. 1923, *A.F.G. Kerr* 7926 (BK, BM, K); Bang Khen, 26 Nov. 1953, *K. Suvathabhandhu* 350 (BK)]; SOUTH-EASTERN: Chon Buri [Nah Kate feelds near Si Racha, 23 Nov. 1927, *D.J. Collins* 1910 (BK, K); Khao Khiao, Si Racha, 22 Nov. 1975, *J.F. Maxwell* 75-1089 (AAU, BK, L)], Rayong [Laem Son, 20 Nov. 2005, *P. Traiperm* 293 (BCU, BKF, KKU)], Chanthaburi [Plain of Makham, 19 Nov. 2005, *P. Traiperm* 291 (BCU, BKF, KKU)]; PENINSULAR: Chumphon [13 Jan. 1927, *A.F.G. Kerr* 11401 (BK, K)], Satun [Nikhom Sahug Eng, Soi 6, Kuan Gah Long, Kuan Gah Long, 10 Oct. 1986, *J.F. Maxwell* 86-789 (CMU, PSU)].

Distribution.— Worldwide.

Ecology.— Very common in paddy fields, roadsides, up to 1800 m altitude. Flowering in April to January.

Vernacular.— Ka dueai nu (กระเดือยหนู), Ya kraduk kai (หญ้ากระดูกไก่) (Chai Nat); Ya daeng (หญ้าแดง), Ya nok si chomphu (หญ้านกสีชมพู)(Krung Thep Maha Nakhon); Ya phraek daeng (หญ้าแพรกแดง) (Ang Thong); Wrinkle duck-beat.

Notes.— *Ischaemum rugosum* is similar to *I. barbatum* in a number and shape of transverse ridge, but differs in having an indurate yellowish-green lower glume below, greenish on the upper, while brownish or reddish lower glume in *I. barbatum*.

10. Ischaemum tenuifolium A. Camus, Bull. Mus. Hist. Nat. Paris: 284. 1919.— Type: Laos, *M. Counillon* s.n. (holotype P!, phototype K!).

Perennial, tufted. *Culms* erect up to 1.5 m tall, terete, internodes glabrous, nodes glabrous. *Leaf-sheaths* tight, up to 15 cm long, glabrous. *Ligules* ciliate, *ca.* 1 mm long. *Leaf-blades* up to 50 cm by 0.3–0.5 mm, upper surface pruinose and slightly pilose, lower surface glabrous, margins scabrous and involute. *Inflorescences* digitate racemes, 3–7 racemes, 6–12 cm long, rachis internodes clavate, 3–3.5 by *ca.* 1 mm, pilose along the angles, nodes long ciliate, hairs up to 4 mm long. *Sessile spikelet*; lower glume lanceolate, 3.5–4.5 mm long, 2-nerved, subcoriaceous, scabrous on the upper nerve, concave along the length, margins folded and ciliate on the upper, apex bifid; upper glume lanceolate, plicate or narrowly boat-shaped, 8–9 mm long, subcoriaceous, keel along the back, prolonged from awned, pilose on upper keeled and upper margins. *Lower floret*; lemma *ca.* 3 mm long, hyaline, folded, upper margins ciliate; palea absent. *Upper floret*; lemmas *ca.* 4 mm long, bifid, twisted awn from sinus, 15–20 mm long; upper palea 2.5–3 mm long, hyaline, expanded at base, upper margins ciliate. *Pedicelled spikelet* dissimilar to the sessile spikelet. *Pedicels* clavate, 2.5–3 mm long, pilose along the angles. *Glumes*; lower glume lanceolate, 3–3.5 by *ca.* 1 mm, 2-nerved, subcoriaceous on each margin, scabrous; upper glume boat-shaped, 3–4.5 mm long, scabrous keel along the back, sometime prolonged from awn. *Lower floret*; lemma oblong, *ca.* 3 mm long, hyaline, sometime absent; palea absent. *Upper floret*; lemma hyaline, *ca.* 3 mm long, bifid, twisted awn from sinus, 10–12.5 mm long; palea *ca.* 2.5 mm long, hyaline, expanded at base.

Thailand.— NORTH-EASTERN: Loei [Phu Kradueng, 10 Nov. 1970, *Ch. Charoenphol et al.* 4879 (AAU, BKF, C, E, K, P)]; EASTERN: Nakhon Ratchasima [Pak Thong Chai, 25 Dec. 1923, *A.F.G. Kerr* 8108 (K); Khao Saming, 25 Nov. 1924, *A.F.G. Kerr* 9395 (K); Bua Yai, 31 Oct. 1931, *Put* 4232 (K)], Ubon Ratchathani [km 36 on road 217 E of Warin Chamrap, 27 Oct. 2001, *S. Laegaard et al.* 21812 (AAU, K, L); 22 Oct. 2005, *P. Traiperm* 233 (BCU, BKF, KKU)]; SOUTH-EASTERN: Chanthaburi [Makham, 19 Nov. 2005, *P. Traiperm* 287 (BCU, BKF, KKU)].

Distribution.— Indo-China.

Ecology.— Secondary grasslands or in dipterocarp forests, Dense tussock, up to 130 m altitude. Flowering in October to December.

Notes.— *I. tenuifolium* is distinct with a pruinose on the upper surface of lamina. This species proved that indeed it belongs in *Andropogon*. So, I place *I. tenuifolium* under *Andropogon*, not *Ischaemum*.

11. Ischaemum timorense Kunth, Rev. Gram. 1: 369. 1830.— Type: Timor, *Wall. Cat. no.* 8863 (holotype K!, CAL).

Andropogon timorensis Steud., Syn. Pl. Glumac. 1: 376. 1855. — Type: Timor (not seen).

I. macrurum Stapf ex Ridl., Fl. Mal. Penins. 5: 203. 1925.— Type: Peninsular Malaysia, Negri Sembilan, *H.N. Ridley* 10013 (lectotype K!, selected here).

Annual, rhizomatous, long creeping. *Culms* erect, 20–45 cm tall, rooting from the lower nodes, nodes slightly to densely long ciliate, internodes glabrous. *Leaf-sheaths* tight, 3–7 cm long, glabrous or sometimes pilose on both margins. *Ligules* ciliate or membranous with ciliate margins, 1–1.3 mm long. *Leaf-blades* lanceolate, 2–9 by 0.5–1.2 cm, pilose on both surfaces, margins scabrous, acute at the apex. *Inflorescences* racemes on terminal, 2.5–6 cm long, separating into 2 racemes, rachis internodes triangular, 2.5–3 mm long, hairy along the angles, nodes long ciliate, hairs up to 2 mm long, callus 0.3–1 mm long. *Sessile spikelet*; lower glume ovate-bifid, like boat-shaped, foliar, 3–4 mm long, 6–8-nerved folded, outer nerves prolonged form 2 points, wingless, glabrous on the back or pilose on the upper part or scabrous along nerves, margins scabrous; upper glume boat-shaped, 4.5–7 mm long, 5–6-nerved, apex with a long scabrous tail which prolonged from the mid nerved, tail 1–3 mm long, wing on the upper back, upper margins ciliate, lower glabrous. Lower floret; lemma *ca.* 3 mm long, 2-nerved and scabrous along nerve, margins plicate and ciliate; palea *ca.* 3 mm long, 1-nerved, hyaline, folded, ciliate along margins, thinner than lemmas. *Upper floret*; lemmas 2–2.5 mm long, hyaline, apex bifid, geniculately awned from sinus, awn twisted, 12–15 mm, margins ciliate, folded; palea lanceolate, 3–3.5 mm long, hyaline, slightly folded, upper margins ciliate. *Lodicules* cuneate. *Anthers ca.* 1.5 mm long. *Pedicelled spikelets*; pedicels triangular shaped, 1.5–3 mm long, hairy along the angles. *Glumes*; lower glume boat-shaped, 3–4 mm long, slightly winged on keel, midnerved prolonged into long tail, scabrous along nerved, sometime pilose on the back, upper margins ciliate; upper glume boat-shaped, 4–4.5 mm long, scabrous along mid-nerve and pilose on the upper back, upper margins ciliate, apex

with long tail. Lower floret; lemma 2.5–3 mm long, 2–nerved, scabrous along nerve, margins ciliate; palea 2.5–3.5 mm long, 1-nerved, hyaline, slightly folded, upper margins ciliate. *Upper floret*; lemma boat-shaped, *ca.* 2 mm long, hyaline, bifid, geniculately awned from sinus, awn twisted, 8–10 mm long; palea *ca.* 2.5 mm long, hyaline, slightly folded, upper margins ciliate. *Anthers*, *ca.* 2 mm long, yellow. *Stigmas* purplish. *Caryopsis* ellipsoid, *ca.* 1-1.2 mm long (Fig. 5.32A-C).

Thailand.— NORTHERN: Chiang Rai [Doi Thung, 12 Jan. 1975, *R. Geesink et al.* 8265 (C, L)]; CENTRAL: Krung Thep Maha Nakhon [31 Jan. 1920, *A.F.G. Kerr* 3974 (K); 25 Nov. 1923, *A.F.G. Kerr* 7937A (BK, BM)]; SOUTH-WESTERN: Kanchanaburi [near Neckey, near Wangka, 18 May 1946, *G. den Hoed* 590 (K, P); Ban Pilog, E-Tong, 20 Feb. 1967, *C. Chermsirivathana* 647 (BKF); 29 Dec. 2005, *P. Traiperm* 354 (BCU, BKF, KKU), 355 (BCU, BKF, KKU), 357 (BCU, BKF, KKU), 358 (BCU, BKF, KKU), 359 (BCU, BKF, KKU), 360 (BCU, BKF, KKU)]; PENINSULAR: Chumphon [27 Jan. 1927, *A.F.G. Kerr* 11647 (BKF, K)], Ranong [Kraburi, 25 Dec. 1918, *A.F.G. Kerr* 16367 (BK, BM, K); 23 Nov. 1983, *Y. Paisooksantivathana* y 1370-83 (BK); Kaper, Laem Son National Park, 30 Jan. 1927, *A.F.G. Kerr* 11705 (BK, K); 30 Nov. 1996, *J.F. Maxwell* 96-1570 (L)], Surat Thani [Khao Phra Mi, 9 Jan. 1966, *B. Hansen & T. Smitinand* 11869 (BKF, C, E, K, L)], Phangnga [Langsan, 7 Feb. 1927, *A.F.G. Kerr* 11866 (BK, K); 6 Mar. 1930, *A.F.G. Kerr* 18396 (BK, BM); Takua Pa, 6 Mar. 1972, *J. Sadakorn* s.n. (BK)], Trang [Kachawng, *L. Williams* 17246 (K)], Songkhla [Suan Dtoon Falls, Mueang, 12 Feb. 1985, *J.F. Maxwell* 85-178 (BKF, P, PSU)], Yala [Padang Besar, 23 Dec. 1927, *A.F.G. Kerr* 13571 (BK, BM, K)].

Distribution.— Africa, China, India, Indo-China, Malesia, South America, Northern South America, and western South America.

Ecology.— Very common along roadsides, near stream in savannah, weed in partly shaded area or in evergreen forest up to 1,500 m altitude. Flowering in November to March.

Notes.— *Ischaemum timorense* differs from *I. indicum* in normally having the lower glume wingless whereas the distinct wing in *I. indicum*, however intermediates wing do occur in some specimens.

Two collections, *H.N. Ridley* 10013 and *Hullett* s.n. were mentioned in the original description. *H.N. Ridley* 10013 kept at K is chosen as the lectotype because it is well preserved.

12. Ischaemum sp.1

Annual, tufted, caepitose. *Culms* erect, sometime prostrate, slender, terete, 25–45 cm tall, internodes and nodes glabrous. *Leaf-sheaths* loose, 3–5 cm long, glabrous, margins thin. *Ligules* long membranous, 2–2.5 mm long, glabrous. *Leaf-blades* 4.5–8.5 by 0.5–0.8 cm, pubescent on both surfaces, recurved, margins folded, base tapering, acute at the apex. *Inflorescences* racemes, terminal, 5–6 cm long, conjugate with 2 racemes, rachis internodes triangular, 3.5–4 mm long, pilose along keel, nodes with a ring of cilia, callus *ca.* 1.5 mm long. *Sessile spikelet*; lower glume oblong, 6.5–7 by 1.5–2 mm, pilose on the back, margins nearly smooth or with one marginal nodule at each edge, apex bifid with 2 subequal apical wings, wings scabrous; upper glume boat-shaped, 7–7.5 by *ca.* 1 mm, keeled along the back, wing on the upper keel, wing scabrous, margins ciliate. *Lower floret*; lemma lanceolate, 5.5–6 by *ca.* 1 mm, hyaline, slightly folded, upper margins ciliate, apex muticous; palea elliptic, *ca.* 5 by 0.8–1 mm, hyaline, slightly folded, upper margins ciliate, apex muticous. *Lodicules* cuneate, *ca.* 0.8 mm long. *Anthers ca.* 2 mm long. *Upper floret*; lemmas 4–5 mm long, hyaline, folded, apex bifid with geniculately awned from sinus, awn twisted, 18–20 mm long, upper margins ciliate; palea oblong-muticous, *ca.* 4 by 0.8 mm, hyaline. *Lodicules* cuneate, *ca.* 1 mm long. *Anthers ca.* 2 mm long. *Pedicelled spikelets*; pedicels clavate, 4–4.5 mm long, pilose along keel. *Glumes*; lower glume oblong-ovate, *ca.* 6 by 1.5 mm, with 2 subequal wings along margins, wing scabrous, pilose on the back, margins folded, apex bifid; upper glume boat-shaped, *ca.* 6.5 by 1 mm, pilose on the back, margins ciliate. *Lower floret*; lemma lanceolate-acute, *ca.* 5 by 1 mm, hyaline, slightly folded, upper margins ciliate; palea oblong-muticous, *ca.* 3 by 0.7 mm, hyaline. *Upper floret*; lemma *ca.* 4 by 1 mm, hyaline, slightly folded; palea *ca.* 3 by 0.5 mm, hyaline. Anthers *ca.* 2 mm long (Figs. 5.3 & 5.32D. & E).

Thailand.— SOUTH-EASTERN: Chanthaburi [Khao Soi Dao, 12 Dec. 2005, *P. Traiperm* 327 (BCU, BKF, KKU) PENINSULAR: Krabi [Phanom Bencha, 28 Mar. 1930, *A.F.G. Kerr* 18716 (BM, K)].

Distribution.— Endemic to Thailand.

Ecology.— Growing on an open ground in evergreen forest on high mountain up to 1,450 m altitude. Flowering in December to March.

Notes.— *Ischaemum* sp.1 resembles to *I. barbatum* in the lower glume of the sessile spikelet. However, the latter is easily distinguished by its coarsely ridge more than one across the back or with 2 or more nodules along the margins. *I.* sp.1 has pubescent on both surfaces of the leaf, margins recurved or folded, while *I. barbatum* flattened leaf-blade, which glabrous to pilose on both surfaces.

13. Ischaemum sp.2

Perennial, tufted. *Culms* erect, terete, up to 1 m tall, nodes with long ciliate, internodes glabrous. *Leaf-sheaths* nearly tight, 5.5–10 cm long, glabrous below, upper pilose with tubercle-based hairs especially near the junction of leaf-blades and leaf-sheaths. *Ligules* prominently membranous 1.5–2 mm long. *Leaf-blades* 8–25 by 0.6–0.8 cm, glabrous on both surface, pilose with tubercle-based hairs below, margins scabrous, sometimes with tubercle- based hairs below, acute at the apex. *Inflorescences* racemes, V-shaped, terminal, 7.5–10 cm long, separating into 2–3 racemes, rachis internodes oblong, *ca.* 3 mm long, pilose along the angles, nodes hirsute, callus *ca.* 1 mm long. *Sessile spikelet*; lower glume oblong, 5–6.5 mm long, 4–6-nerved, expanded and indurate, upper foliose, hirsute on the back, apex bifid with 2-apical wing, wings scabrous, marginals nerves prolonged form 2 long tail at the apex; upper glume boat-shaped, 8–9 mm long, subcoriaceous, scabrous winged on keel, keeled prolonged from long tail, pilose on the upper back, upper margins ciliate. *Lower floret*; lemma, *ca.* 5 mm long, 1-nerved, chartaceous, upper margins ciliate; palea *ca.* 5 mm long, 2-nerved and plicate on each margins, upper margins ciliate. *Anthers* yellow, *ca.* 2.5 mm long. *Upper floret*; lemmas boat-shaped, *ca.* 5 mm long, hyaline, apex bifid with geniculately awned from sinus, awn twisted, 18–20 mm long, upper margins ciliate; palea narrow, *ca.* 5 mm long, hyaline. *Pedicelled spikelets*; pedicels clavate, *ca.* 3 mm long, pilose along the angles. *Glumes*; lower glume folded, 7–8 mm long, scabrous wing along keel, awn from mid-nerve, hirsute on the back; upper glume folded, narrower than the lower glume, 7–8 mm long, scabrous winged on keel, awn from mid-nerved, hirsute on the back, ciliate along margins. *Lower floret*; lemma folded, 3.5–4.5 mm long, 1-nerved, chartaceous, upper margins ciliate;

palea 3.5–4.5 mm long, 2-nerved and plicate on each margins, upper margins ciliate. *Anthers* yellow, 1.8–2.5 mm long. *Upper floret*; lemma boat-shaped, 4.5–5 mm long, upper margins ciliate, bifid, geniculately awned from sinus, awn twisted, 15–18 mm long; palea narrowly lanceolate, 3.5–4.2 mm long, hyaline (Fig. 5.4).

Thailand.— PENINSULAR: Ranong [Phu Khao Yah, 26 Oct. 2004, *P. Traiperm* 148, 149 (BCU, BKF, KKU)].

Distribution.— Endemic to Thailand.

Ecology.— Savannah or in wet places up to 600 m altitude. Flowering in November to March.

Notes.— This species resembles to *I. lacei*, but it is distinguished by its glabrous leaf blade, while pilose with tubercle-based hairs on both surfaces of the leaf in *I. lacei*.

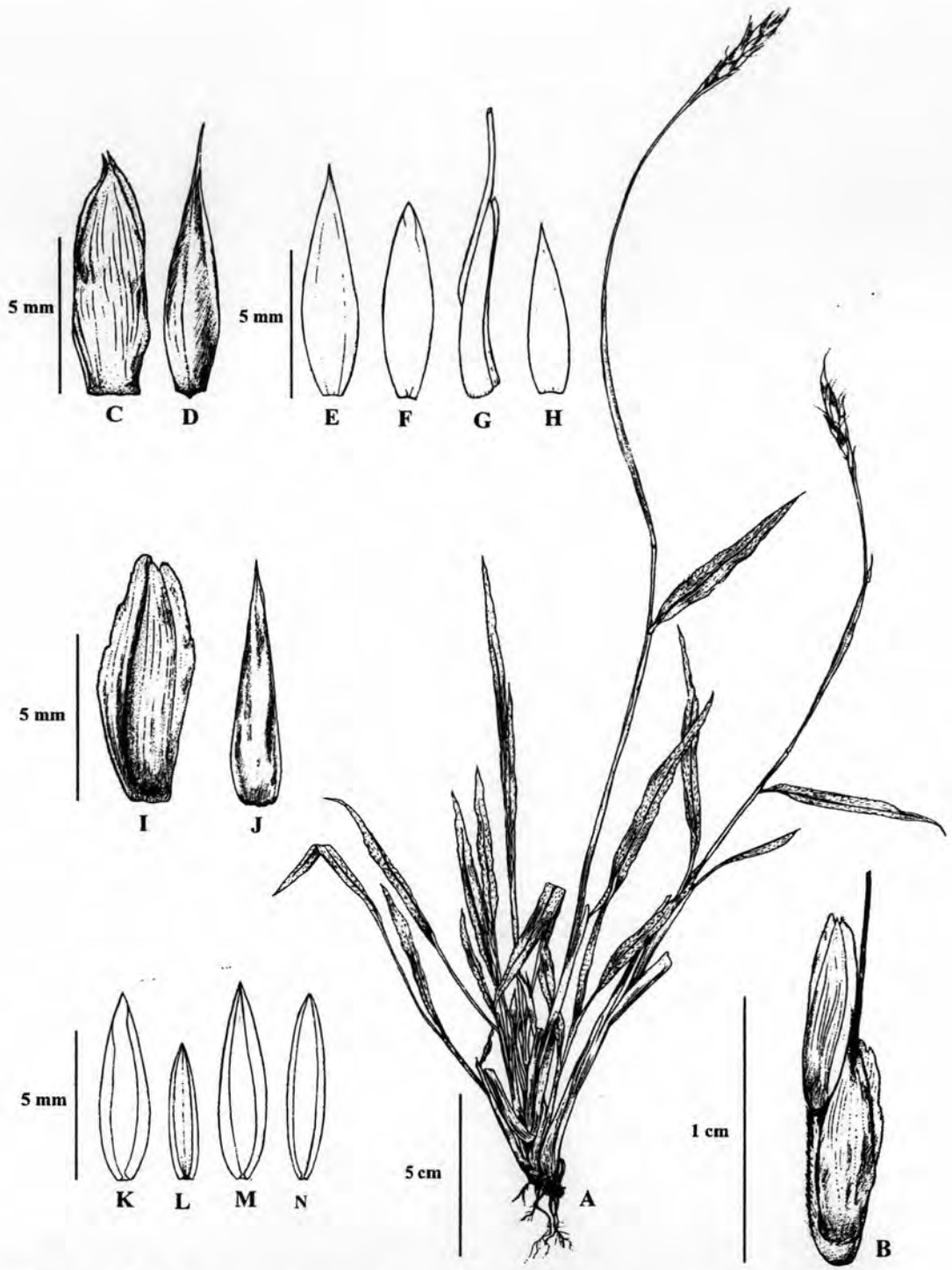

Figure 5.2 *Ischaemum hubbardii*: A. plant; B. spikelet pair; C-H. sessile spikelet: C. lower glume, D. upper glume, E. lower lemma, F. lower palea, G. upper lemma, H. upper palea; I-N pedicelled spikelet: I. lower glume, J. upper glume, K. lower lemma, L. lower palea, M. upper lemma, N. upper palea. All line drawings were drawn by P. Traiperm from *P. Traiperm* 308.

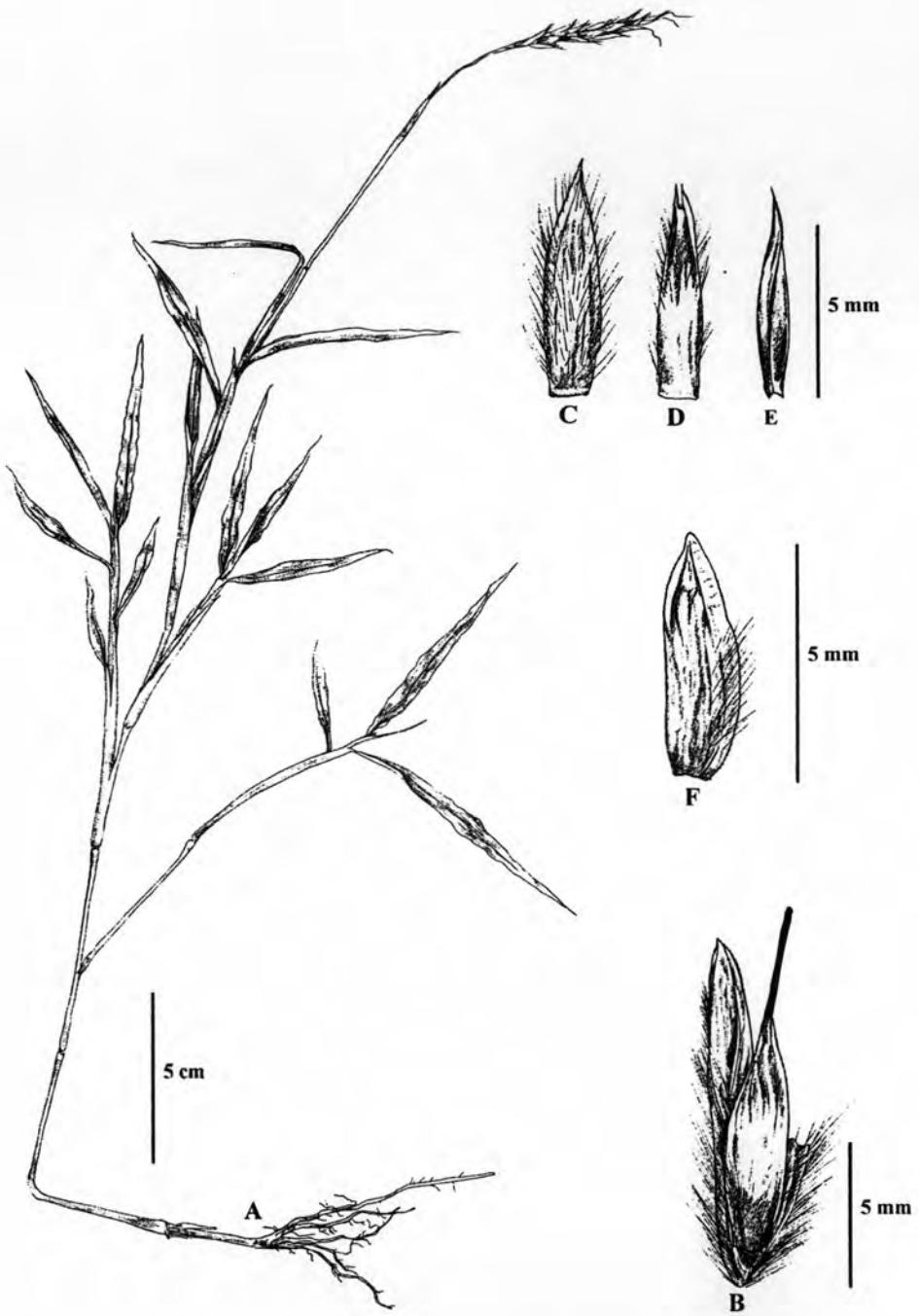

Figure 5.3 *Ischaemum* sp.1: A. plant; B. spikelet pair; C-E. sessile spikelet: C. & D. lower glume (two views), E. upper glume; F. lower glume of pedicelled spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 327.

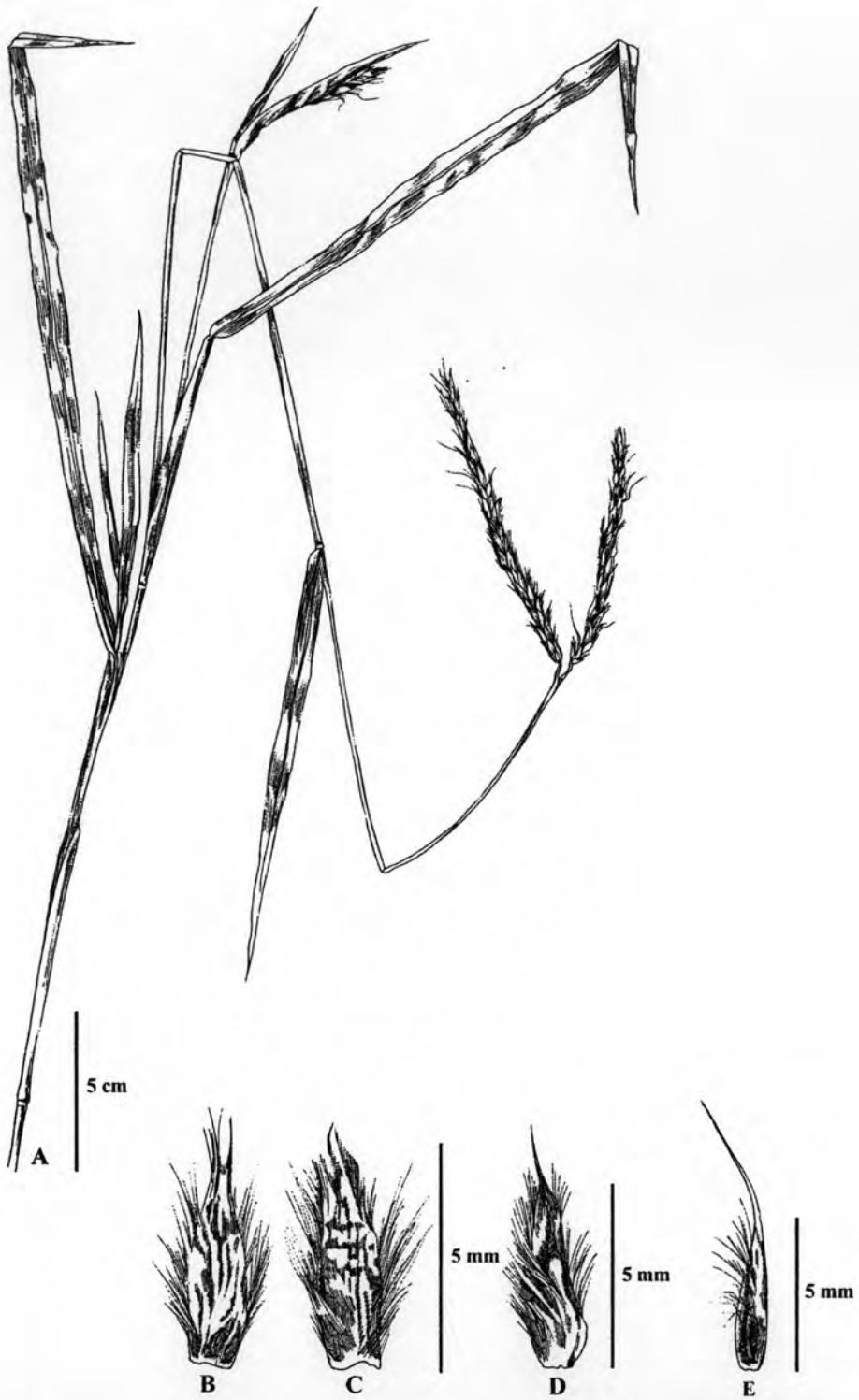

Figure 5.4 *Ischaemum* sp.2: A. habit; B-D. sessile spikelet: B. & C. two views of the lower glume, D. upper glume, E. upper glume of pedicelled spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 149.

3. KERRIOCHLOA

C.E. Hubbard in Hook., Ic. Pl. 35: t. 3494. 1951.— Type species: *K. siamensis* C.E. Hubbard.

Perennial. *Culms* decumbent, slender. *Leaf-sheath* loose, glabrous or slightly villous. *Ligules* membranous. *Leaf-blades* lanceolate, chartaceous, glabrous on both surfaces. *Inflorescence* a single raceme, terminal or sometimes axillary, subtended by a linear spatheole which enclosed; rachis fragile at the nodes, villous. *Spikelets* in pairs. *Sessile spikelet* laterally compressed. *Glumes*; lower glume lanceolate or boat-shaped, chartaceous; upper glume ovate, complicate, chartaceous, bifid at the apex and awned from sinus. *Florets* 2, lower floret sterile; lemma awnless. *Upper florets* fertile; lemma with geniculate awn from sinus. *Pedicelled spikelet* sterile, much reduced, composed of only one glume, lanceolate, villous. *Pedicels* oblanceolate, villous. *Lodicules* cuneate, *ca.* 0.5 mm long. *Ovary* cylindrical, *ca.* 1 mm long. *Stamens* 3, yellow, 3–4 mm long. *Caryopsis* elliptic, *ca.* 1.5 mm long.

A genus of one species only in Thailand and Vietnam.

1. Kerriochloa siamensis C.E. Hubbard in Hook., Ic. Pl. 32 t. 3494. 1951.— Type: Thailand, Chanthaburi: Kao Knap, *A.F.G. Kerr* 17718 (holotype K!, isotypes BK!, BM!).

Perennial, stoloniferous. *Culms* decumbent, 30–50 cm long, subterete, glabrous. *Leaf-sheath* loose, 2.5–4 cm long, glabrous or slightly villous, margins ciliate. *Ligules* membranous, *ca.* 1.5–2 mm long. *Leaf-blades* lanceolate, 2.5–8 by 0.7–1.3 cm, chartaceous, glabrous on both surfaces, margins scabrous or slightly pilose hairs, base cordate, apex acute. *Inflorescence* a single raceme, 5–8 cm long, subtended by a linear spatheole which enclosed; rachis fragile at the nodes, flattened, rachis internodes cuneate, *ca.* 4 mm long, margins villous; spikelets in pairs. *Sessile spikelets* laterally compressed. *Glumes*; lower glume lanceolate and boat-shaped, 6–6.5 by *ca.* 1.5 mm, 5–nerved, chartaceous, keel on 1/3 on the upper part of the back, villous on the lower half part; upper glume ovate, complicate, *ca.* 6 by 2.5 mm, 3-nerved, chartaceous, bifid at the apex and awned from sinus, awn 8–9 mm long, margins of the upper glume, ciliate 1-keeled on the back, keel scabrous. *Lower floret*

sterile; lemma oblanceolate, *ca.* 6 by 0.8 mm, 3-nerved, membranous, upper margins ciliate; palea lanceolate, *ca.* 5 by 0.7 mm, membranous, 2-nerved, apex acute, upper margins ciliate. *Ovary* cylindrical, 1 mm long. *Upper florets* fertile; lemma oblong, *ca.* 3.5 mm long, 3-nerved, hyaline, margins ciliolate, hairy above, apex bifid, incised, 0.4 of lemma length, awn from sinus, geniculate, 28–35 mm long; with twisted column; palea lanceolate, *ca.* 3 mm long, 3-nerved, hyaline. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers* 3, yellow, 3–4 mm long. *Pedicelled spikelet* sterile, smaller than sessile spikelet; composed of only one glume, lanceolate, *ca.* 2 mm long, villous. *Pedicels* oblanceolate, villous on both margins, apex curved. *Caryopsis* elliptic, *ca.* 1.5 mm long (Figs. 5.5 & 5.33A. & B).

Thailand.— EASTERN: Ubon Ratchathani [Warin Chamrap, 27 Oct. 2001, *S. Laegaard* 21830 (AAU); 22 Oct. 2005, *P. Traiperm* 235 (BCU, BKF, KKU); *ca.* 5 km of dam of Khong Chiam, 27 Oct. 2001, *S. Laegaard* 21844 (AAU); Pha Taem Nat. Park, 23 Oct. 2005, *P. Traiperm* 245 (BCU, BKF, KKU)]; SOUTH-EASTERN: Chanthaburi [Kao Knap, 23 Dec. 1929, *A.F.G. Kerr* 17718 (BK, BM, K)].

Distribution.— Vietnam.

Ecology.— Creeping over the rocks or in open sandy soil, at 140-600 m altitude. Flowering between October and December.

Notes.— *Kerriochloa siamensis* is easily recognized by a laterally compressed sessile spikelets and a linear spatheole, which are enclosed the inflorescence.

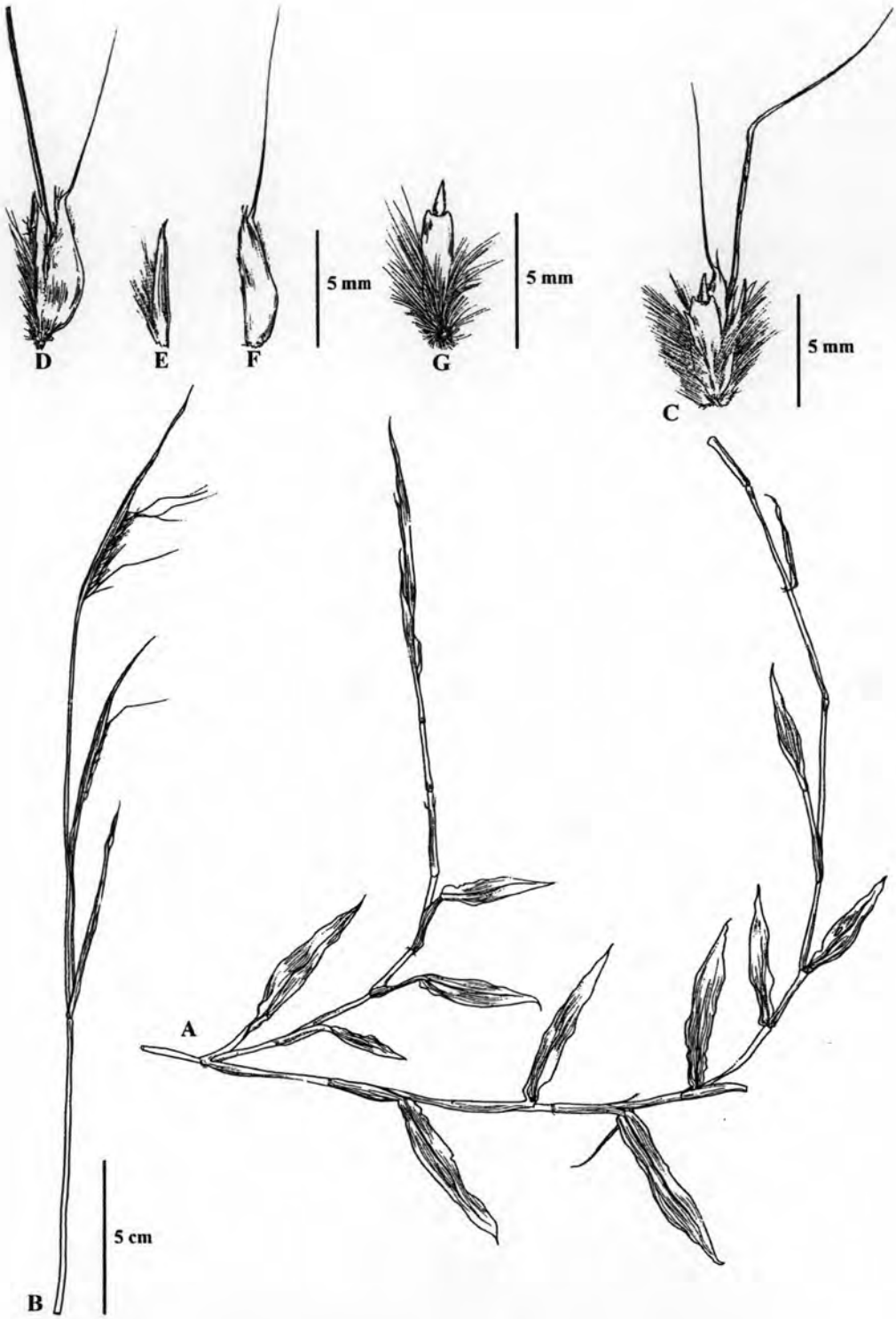

Figure 5.5 *Kerriochloa siamensis*: A. plant; B. inflorescence; C. spikelet pair; D-F. sessile spikelet: D. sessile spikelet, E. lower glume, F. upper glume; G. pedicelled spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 235.

4. SEHIMA

Forssk., Fl. Aegypt.-Arab.: 178. 1775.— Type species: *S. ischaemodies* Forssk.

Hologamium Nees in Edinb. New Phil. J. 18: 185. 1835.— Type species: *H. nervosum* (Rottler) Nees.

Perennial. *Culms* erect. *Leaf-sheaths* tight. *Ligules* membranous with cilia. *Leaf-blades* linear, scabrous, apex long acuminate. *Inflorescence* solitary raceme, terminal and axillary. *Spikelet* in pairs. *Sessile spikelets* dorsally compressed, fitting between internode and pedicel. *Glumes*; lower glume chartaceous with deeply grooved, particularly below the middle; upper glume boat-shaped, subchartaceous, keeled, ciliate along the upper margins at the apex and passing into a fine bristle. *Lower floret* neutral, lemma oblong-lanceolate or boat-shaped, awnless; palea linear, awnless. *Upper floret* perfect; lemma apex bifid with geniculate awn from sinus; palea oblong, awnless. *Pedicelled spikelet* lanceolate, larger than the sessile spikelet, dorsally compressed. *Pedicels* same as the rachis. *Glumes*: lower glume lanceolate, distinctly 5-nerved, coriaceous, outer green, inner purple; upper glume boat-shaped or lanceolate, 3-nerved, membranous. *Lodicules* conical. *Stamens* brown. *Ovary* obovate. *Stigmas* brownish-yellow. *Caryopsis* dorsally compressed.

A genus of 5 species in the Old World tropics: one species occurs in Thailand.

S. sulcatum (Hack.) A.Camus has been reported from Thailand (Nanakorn & Norsaengsri 2001) but no herbarium specimen is available for confirmation.

1. Sehima nervosum (Rottler) Stapf in Prain, Fl. Trop. Afr. 9: 36. 1917.

Andropogon nervosus Rottler in Ges. Naturf. Fr. N.S. 4: 218. 1803.— Type: India, *Rottler* s.n. (holotype K!).

Ischaemum laxum R. Br.: Prodr. 205. 1810.— Type: Australia, *R. Brown* 6155 (holotype K!, isotypes BM!, E!).

A. philippinensis Merr., Philipp. Journ. Sc. 14: 367. 1919.— Type: Philippines, Luzon, Burgos, *M. Ramos 32946*, July 1918, (holotype K!).

Perennial. *Culms* erect, 30–150 cm long, slender, terete, glabrous. *Leaf-sheaths* tight, 6–15 mm long, terete, glabrous or slightly hirsute. *Ligules* membranous, ciliate, *ca.* 1 mm long. *Leaf-blades* linear, 20–45 cm by 4–6 mm, scabrous, margins

with short rigid hairs, apex long acuminate. *Inflorescence* solitary racemes, long erect or slightly curved, terminal and axillary, 8–12 cm long; joints and pedicels parallel, compressed, 4–5 mm long, densely ciliate with white hairs on both margins and joints. *Sessile spikelets* dorsally compressed, 8–9 mm long, pale green. *Glumes*; lower glume oblong, 8–9 by 1 mm, 4-nerved, chartaceous, deeply grooved, particularly below the middle, distally with transverse veinlets, apex bidentate; upper glume boat-shaped, 6–15 mm long, subchartaceous, keeled, ciliate along the upper margins at the apex and passing into a fine bristle. *Lower floret* neutral, lemma oblong-lanceolate or boat-shaped, 3–6.5 by 0.8 mm, 2-nerved, hyaline, margins entire; palea linear, 6–7 by 0.8 mm, hyaline. *Upper floret* perfect; lemma, 4–7 mm long; bifid, geniculately awned from sinus, awn 2.5–4 cm long, slender, spirally twisted; palea oblong, 6–6.5 by 0.8 mm, hyaline. *Lodicules* conical, 4–5 mm long. *Anthers* brown, *ca.* 2–3.5 mm long. *Ovary* obovate, 1–2 mm long. *Stigma* brownish-yellow. *Pedicelled spikelet* lanceolate, larger than the sessile spikelet, dorsally compressed; rachis triangular, 4–5 mm long, compressed, white marginal hairs along the angles. *Pedicels* same as the rachis. *Glumes*; lower glume lanceolate, 8–11 mm long, 5-nerved, coriaceous, outer green, inner purple, apex bifid, long-ciliate from the the tightly inflexed margins; upper glume boat-shaped or lanceolate, 5–9 by 1.2–1.5 mm, 3-nerved, membranous, ciliate along the margins. *Lower floret*; lemma lanceolate, 7–7.5 by 1 mm, hyaline, margins folded and ciliate; palea oblong-lanceolate, 6–7 by 0.8 mm, hyaline. *Upper floret*; lemma narrowly lanceolate, 7–8 by 1 mm, hyaline, margins folded and ciliate; upper palea narrowly lanceolate, 6.5–7 by 0.8 mm, hyaline, margins folded. *Caryopsis* dorsally compressed (Figs. 5.6 & 5.33C-E).

Thailand.— NORTHERN: Chiang Mai [Doi Suthep, 24 Nov. 1911, *A.F.G. Kerr* 2255 (E, K); Wang Saphung, Sithan, 17 Oct. 1955, *T. Smitinand* 3052 (BKF); *Khantachai* 697 (BKF); Doi Tao, Mae Doop Reservoir, dam area, 23 Oct. 1987, *J.F. Maxwell* 87-1248 (BKF, CMU, L); Hot, Op Luang, 19 Oct. 1989, 89-1256 (CMU, L); 23 Nov. 2005, *P. Traiperm* 300 (BCU, BKF, KKU); Mae Soi Valley, 10 Nov. 1990, *J.F. Maxwell* 90-1253 (AAU, CMU, L); Doi Saket, Huai Heng Khrai Royal Development Project, 8 Nov. 1993, *S. Suwannaratana* 34 (L); Along road to Doi Inthanon, *ca.* 5 km from Chom Thong, 3 Oct. 2001, *S. Laegaard & M. Norsaengsri* 21661 (AAU); 15 Oct. 2001, 21715 (AAU, L)], Lamphun [Mae Tah, Doi Khun Tan National Park, Yaw1 area, 28 Oct. 1993, *J.F. Maxwell* 93-1332 (L)], Lampang [Khun

Tan National Park, 4 Dec. 2005, *P. Traiperm* 323 (BCU, BKF, KKU)], Tak [Bhumipol Dam, *Ploenchit* 411 (BK)]; NORTH-EASTERN: Phetchabun [Tung Luang, 10 Dec. 1931, *A.F.G. Kerr* 20636 (BK, BM, K); at km 25 on road 12 Lom Sak-Khon Kaen, 25 Oct. 2001, *S. Laegaard & M. Norsaengsri* 21785 (AAU, K, L); Nam Nao National Park, 20 Nov. 2004, *P. Traiperm* 170 (BCU, BKF, KKU)], Loei [Phu Kradueng, 10 Nov. 1970, *Ch. Charoenphol et al.* 4889 (AAU, C, E, BKF, K, P); 4891 (AAU)], Nong Bua Lam Phu [12 Nov. 1963, *Pradit* 647 (BK)]; EASTERN: Chaiyaphum [Phu Lan Ka, 1 Jan. 2006, *P. Traiperm* 367 (BCU, BKF, KKU)]; SOUTH-WESTERN: Uthai Thani [Ban Rai, 28 Oct. 1971, *S. Sutheesorn* 3144 (BK)], Kanchanaburi [19 Oct. 1930, *A.F.G. Kerr* 19767 (BK, K); Ban Kao, 11 Nov. 1961, *K. Larsen* 8307 (C, K); Mueang, 15 Nov. 1967, *C. Chermsirivathana* 798 (BKF); 18 Nov. 1970, *M. Lazarides* 7417 (BKF, C, K, L); Si Sawat, 15 Nov. 1971, *C.F. van Beusekom et al.* 3808 (BKF, C, K, L, P)]; SOUTH-EASTERN: Prachin Buri [Watana Nakhon, 18 Nov. 1964, *S. Sutheesorn* 161 (BK)], Chon Buri [11 Jan. 1961, *K. Larsen* 8014 (C); Khao Khiao, Si Racha, 26 Apr. 1975, *J.F. Maxwell* 75-434 (AAU, BK, L); Sichang Island, E side, coastal area near Kow Kwang, Si Racha, 8 Nov. 1992, 92-711 (P)].

Distribution.— India to tropical Australia.

Ecology.— Open, dry dipterocarp forest, at sea level to 950 m altitude. Flowering between September and Apirl.

Notes.— *Sehima nervosum* is distinguished by its pedicelled spikelet, which is larger than the sessile spikelet.

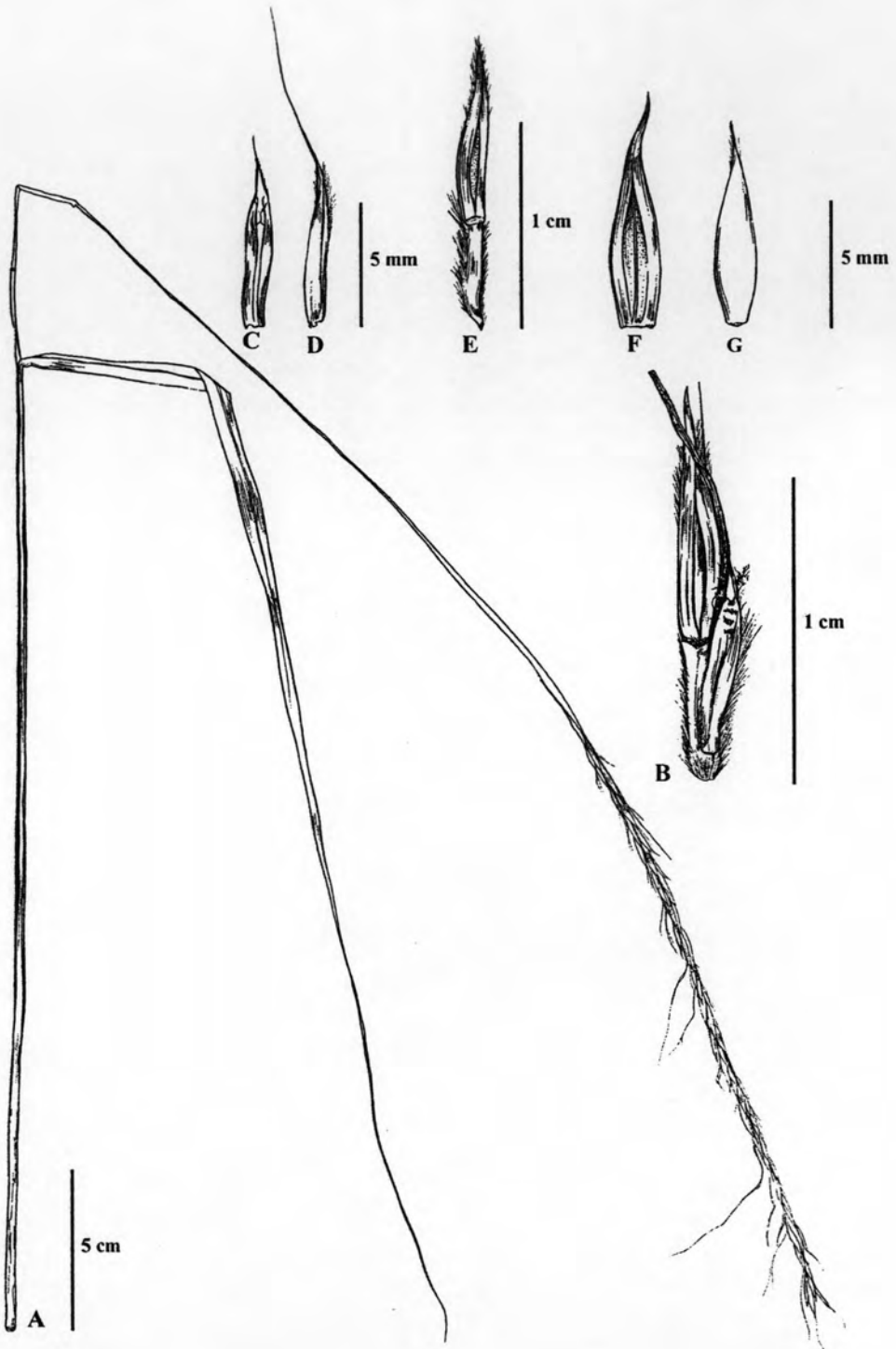

Figure 5.6 *Sehima nervosum*: A. plant; B. spikelet pair; C-D. sessile spikelet: C. lower glume, D. upper glume; E-G pedicelled spikelet: E. pedicelled spikelet with pedicel, F. lower glume, G. upper glume. All line drawings were drawn by P. Traiperm from *P. Traiperm* 300.

5. THELEPOGON

Roem. & Schult., Syst. Veg. 2: 46. 788. 1817.— Type species: *T. elegans* Roem. & Schult.

Rhiniachne Steud., Syn. Pl. Glum. 1: 360. 1854, in syn. sub. *Jardinea abyssinica* (= *T. elegans*).

Annuals, rhizomatous. *Culms* erect, somewhat stout, terete, rooting at base. *Leaf-sheaths* loose, hirsute with tubercle-based hairs and ciliate along outer margins. *Ligules* membranous with ciliate margins. *Leaf-blades* lanceolate to linear-lanceolate, hispid on surface, margins undulate and scabrous. *Inflorescence* digitate racemes. *Sessile spikelet* dorsally compressed. *Glumes*; lower glume ovate-acute, crusrtaceous, broadly convex, rugose, wingless; upper glume narrowly ovate, subcoriaceous, keeled and scabrid, transverse ridge on the middle back. *Lower floret* sterile; lemma ovate, awnless; palea narrower than lemma, awnless. *Upper floret* fertile; lemma ovate or boat-shaped, apex bifid with geniculate awn from a sinus; palea ovate-muticous. *Pedicelled* spikelet absent, represented by a flattened linear pedicel. *Lodicules* cuneate. *Anthers* yellow. *Stigmas* purple. *Caryopsis* elliptic.

A genus of 1 species in the tropical Africa, extending eastwards to Asia and occurs in Thailand. The genus is distinguished from *Ischaemum* mainly by the barren pedicel.

1. Thelepogon elegans Roem. & Schult., Syst. Veg. 2: 46. 788. 1817.— Type: India, *Heyne* (B), not seen.

Annuals, rhizomatous. *Culms* erect, 80–150 cm tall, somewhat stout, terete, glabrous, rooting at base. *Leaf-sheaths* loose, 3–7 cm long, hirsute with tubercle-based hairs and ciliate along outer margins. *Ligules* membranous with ciliate margins, 1–1.5 mm long. *Leaf-blades* lanceolate to linear-lanceolate, 10–25 by 1.5–2.5 cm, hispid on adaxial surface and glabrous or slightly hispid on abaxial surface, margins undulate and scabrous, base round, apex acute. *Inflorescence* digitate racemes, composed of 2–4 racemes, if many the lowest verticillate, simple or divided, rachis fragile at nodes, nodes with a ring of cilia, rachis internodes cuneate, slightly curved, angular and scabrid along the rib, 7.5–8.5 mm long, rachis internodes tip transverse,

cupuliform; spikelet in pairs, composed of fertile sessile spikelets and sterile pedicelled spikelets. *Sessile spikelet* dorsally compressed, ovate, 6–7 mm long. *Glumes*; lower glume ovate-acute, 5–5.5 mm long, 7-nerved, coriaceous, indurate on margins, rugose on the back; upper glume narrowly ovate, *ca.* 7 mm long, 1-nerved, subcoriaceous, keeled and scabrid, 6–8 transverse ridges on the middle back, ciliate along margins long acuminate at the apex. *Lower floret* sterile; lemma ovate, *ca.* 4.2 mm long, hyaline, enfolded, ciliate along the upper part of both margins; palea narrower than lemma, *ca.* 4.2 mm long, hyaline. *Upper floret* fertile; lemma ovate or boat-shaped, *ca.* 4 mm long, 5-nerved, hyaline, ciliate along the upper part of the margins, bifid in a half length, geniculate awn from a sinus, 20–30 mm long with a twisted column, scabrous on whole length; palea ovate-muticous, *ca.* 3.8 mm long, 3-nerved, hyaline. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers ca.* 2.5 mm long, yellow. *Stigmas* purple. *Caryopsis* elliptic, *ca.* 3 mm long. *Pedicelled spikelet* absent (Figs. 5.7 & 5.33F-I).

Thailand.— NORTHERN: Lampang [Mae Mo, 24 Oct. 1971, *T. Boonkird* 1 (BK)]; EASTERN: Nakhon Ratchasima [Klang Dong, 9 Dec. 1962, *C. Phengklai* 407 (BKF, C, K, L); Pak Chong, 31 Dec. 1923, *A. Marcan* 1568 (BK, BM)]; CENTRAL: Lop Buri [Chai Badan, Pasak river, 13 Dec. 1923, *A.F.G. Kerr* 7978 (BK, BM, K, TCD)], Saraburi [Mueang, Sam Lan forest, 20 Oct. 1974, *J.F. Maxwell* 74-953 (AAU, BK, L,); 5 Nov. 2005, *P. Traiperm* 276 (BCU, BKF, KKU); Muak Lek; railway track side, 10 Nov. 1924, *A. Marcan* 1864 (BK, BM)].

Distribution.— Tropical Africa and Asia.

Ecology.— Mostly erect grass, growing in a weedy places on roadsides, deciduous forest, or in open area, at 50-300 m altitude. Flowering between October and December.

Notes.— *Thelepogon elegans* is easily recognised by a special lower glume of the sessile spikelet, which are strongtly rugose. A hispid leaf-blades on adaxial surface and glabrous or slightly hispid on abaxial surface, margins undulate and scabrous.

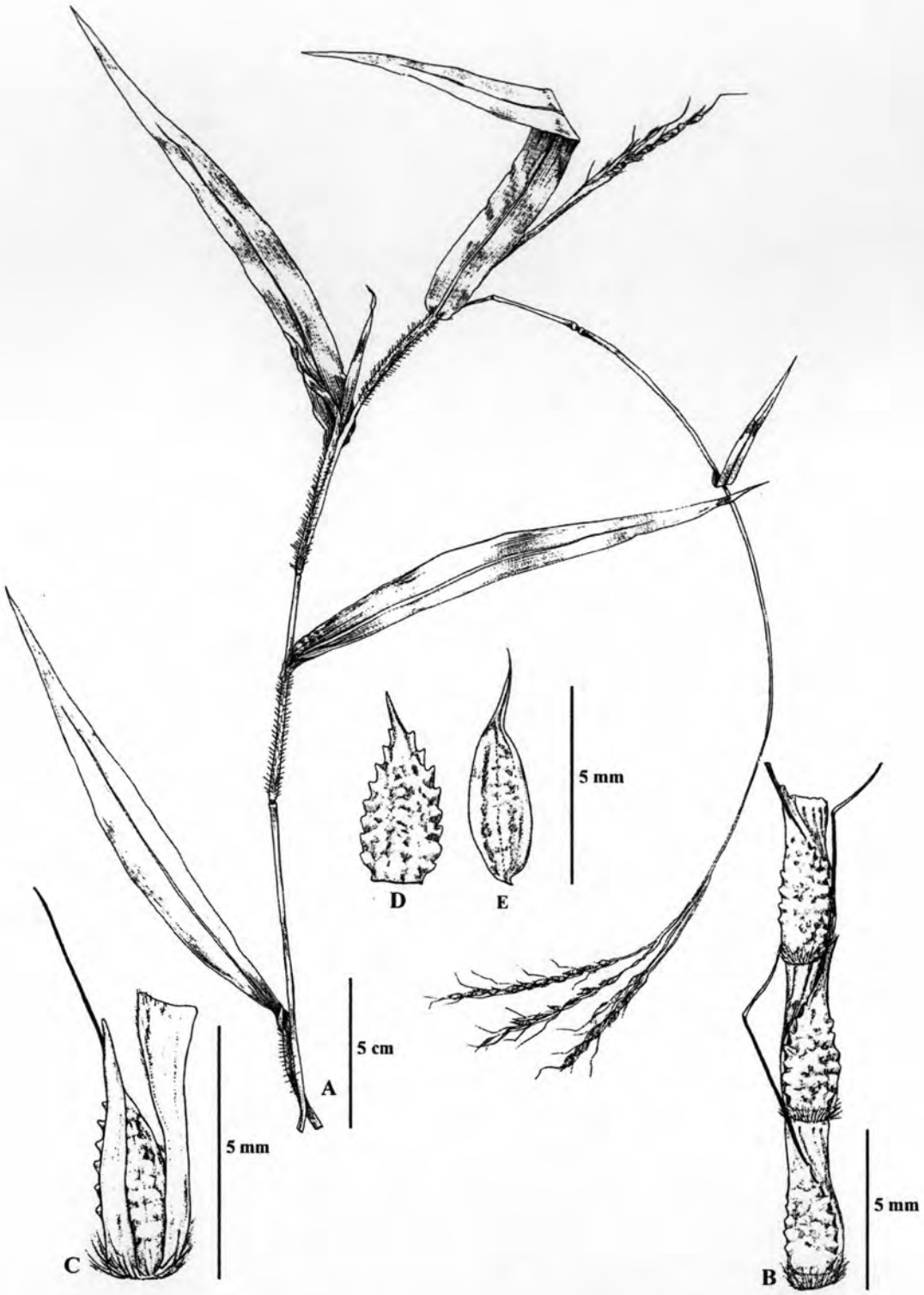

Figure 5.7 *Thelepogon elegans*: A. plant; B. partial raceme; C. spikelet pair; D. lower glume of sessile spikelet; E. upper glume of sessile spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 276.

B. ROTTBOELLIINAE

Presl, Rel. Haenk. 1: 329. 1830.

Ratzeburgiinae Hook.f., Fl. Brit. India 7: 4. 1897.

Inflorescence of single or digitate racemes, terminal, axillary or spathate; racemes fragile, though and rarely tough, the internodes thickened or swollen. *Spikelets* paired, rarely in three, usually dissimilar. *Sessile spikelet* bisexual, dorsally compressed; *lower glume* herbaceous to crustaceous, convex, often sculptured, mostly 2-keeled; lower floret male or barren; *upper lemma* narrowly ovate, entire, awnless. *Pedicelled spikelet* variable, the pedicel sometimes fused to the internode.

About 21 genera (Clayton & Renvoize, 1986) distributed in the tropics of both hemispheres, but mainly occur in Asia and Australia, 8 genera (Keng, 1933), 32 species and 1 infraspecific taxa in Thailand.

KEY TO THE GENERA

1. Racemes several **6. Phacelurus**
1. Racemes single, paired or digitate
  2. Pedicels partly or wholly fused to the internodes
    3. Sessile spikelet globose **2. Hackelochloa**
    3. Sessile spikelet columnar
      4. Pedicelled spikelet present
        5. Rachis of raceme tough **3. Hemarthria**
        5. Rachis of raceme fragile **7. Rottboellia**
      4. Pedicelled spikelet absent
        6. Raceme dorsiventral, spikelets all on the same side **4. Mnesithea**
        6. Raceme symmetrical, spikelets arranged in two opposite rows **5. Ophiuros**
  2. Pedicels free to the internodes
    7. Lower glume of sessile spikelet produced into a long flattened tail **8. Vossia**
    7. Lower glume of sessile spikelet without a herbaceous tail
      8. Pedicelled spikelet present **4. Mnesithea**
      8. Pedicelled spikelet absent **1. Eremochloa**

1. EREMOCHLOA

Buse in Miq., Pl. Jungh. 1: 357. 1854.— Type species: *E. horneri* Buse [= *E. ciliaris* (L.) Merr.].

Ischaemum L. sect. *Pectinaria* Benth., J. Linn. Soc., Bot. 19: 71. 1882.— Type species: *I. ophiuroides* Munro [= *Eremochloa ophiuroides* (Munro) Hack.].

Sehima auct. non Forssk.

Perennial. *Inflorescence* a single terminal, strongly flattened; internodes clavate. *Sessile spikelet*; lower glume chartaceous to coriaceous, the keels pectinately spinose, sometimes winged at tip; lower florets male, with palea. *Pedicelled spikelet* absent or represented by a bristle; *pedicel* free, narrowly foliaceous.

A genus of 11 species from India, Sri Lanka, S China, Indochina, Australia. Distinguished from *Mnesithea* mainly by pectinately spinose at the lower glume of the sessile spikelets.

KEY TO THE SPECIES

1. Lower glume apex with apical wings
   2. Pedicel less than 1.5 times as long as the sessile spikelet
      3. Lower glume setae hook-like, longest ones *ca.* 0.5 mm long, shorter than the width of the lower glume **9. E. petelotii**
      3. Lower glume setae straight, longest ones 1.5–1.6 mm long, as long as the width of the lower glume **11. E. sp.2**
   2. Pedicel more than or equal 1.5 times as long as the sessile spikelet
      4. Lower glume apex with a small apical wings, 0.1–0.3 length of the lower glume
         5. Pedicel subulate or oblique-lanceolate
            6. Pedicel subulate, lower glume setae straight, longest ones 1.5–2.0 mm long, equal or shorter than the width of the lower glume **1. E. attenuata**
            6. Pedicel oblique-lanceolate, lower glume setae straight, longest ones 2.5–3.0 mm long, much longer than the width of the lower glume **7. E. maxwellii**
         5. Pedicel oblique-obovate or obovate, usually with short or long cordate at apex

7. Pedicel oblique-obovate with short cordate at apex, foliose, 4–4.5 mm long, 0.75–0.85 times as long as the sessile spikelet **2. E. bimaculata**

7: Pedicel obovate with long cordate at apex, 4.5–6 mm long, 0.9–1.2 times as long as the sessile spikelet **10. E. sp.1**

4. Lower glume apex with a large apical wings, more than or equal 0.4 length of the lower glume **8. E. muricata**

1. Lower glume apex without apical wing

8. Pedicel more than 1 times as long as the sessile spikelet

9. Lower glume setae flattened, cataphylls woolly hairy **5. E. eriopoda**

9. Lower glume setae terete, cataphylls glabrous **6. E. lanceolata**

8. Pedicel less than 1 times as long as the sessile spikelet

10. Pedicel obovate with long cordate at apex **4. E. ciliatifolia**

10. Pedicel subulate without long cordate at apex **3. E. ciliaris**

1. Eremochloa attenuata Stapf ex Buitenhuis, Blumea 46 (2): 404. 2001.— Type: Thailand, Phu Kradueng, *A.F.G. Kerr* 8686 (holotype BM!, isotypes K! & P!).

Perennial grass, tufted, cataphylls slightly appressed hairs. *Culms* erect, 35–50 cm tall, extravaginal branching at base, internodes with densely pilose hairs, nodes slightly hairs. *Leaf-sheaths* nearly tight, 4–8 cm long, densely white hairy. *Ligules* membranous with ciliate margins, 0.3–0.5 mm long. *Leaf-blades* flat to slightly folded, 8–20 cm by 2–2.5 mm, woolly hairs on both surfaces, acute at apex. *Inflorescence* racemes, solitary, straight, 4–6 cm long, rachis internodes clavate, 3–3.5 mm long, *ca.* 0.75–0.9 length of sessile spikelets, sparsely hairy, joints at base with ciliate hairs. *Sessile spikelets*; lower glume ovate, 4–5 by 1.8–2 mm, distinctly 9–10-nerved, glabrous to sparsely hairy on the back, setae straight, terete, longest ones 1.5–2 mm long, equal or shorter than the width of the lower glume, apex with a small apical wings, 0.2–0.3 length of the lower glume; upper glume oblong, 4–4.5 by *ca.* 1 mm, 3-nerved, keeled in the middle in the lower half and along the margins, distally with transverse veinlets, sparsely hairy on the lower part of the back, margins folded. *Lower floret*; lemma oblong, *ca.* 4 by 1 mm, hyaline, margins folded; palea oblong, *ca.* 3 by 0.8 mm, hyaline. *Upper floret*; lemma oblong, *ca.* 3.2 by 0.8 mm, hyaline, margins folded; palea oblong, *ca.* 3 by 0.5 mm, hyaline. *Lodicules* cuneate *ca.* 0.5 mm long. *Anthers* brown, *ca.* 2.5 mm long. *Ovary* elliptic, *ca.* 1 mm long. *Stigmas*

purplish. *Pedicelled spikelet* absent. *Pedicel*s subulate, 3–3.5 mm long, 0.6–0.7 times as long as the sessile spikelet (Figs. 5.8A-E & 5.34A-C).

Thailand.— NORTHERN: Chiang Mai [Doi Inthanon, 14 Jun. 2004, *P. Traiperm* 111 (BCU, BKF, KKU); Doi Suthep, 20 May 1912, *A.F.G. Kerr* 2607 (K); 12 May 1958, *Th. Sørensen et al.* 3379 (C, K); near Fang, 25 May 1958, *Th. Sørensen et al.* 3583 (C); Wang Bua Ban, *M. Norsangsri* 544, 17 May 1995, (QBG)], Lamphun [between Tak & Lamphun, 6 Jun. 1960, *T. Smitinand & H. St. John* 6799 (BKF, K); Khun Tan National Park, 6 Jun. 1993, *J.F. Maxwell* 93-590 (L)], Lampang [Ngao Mae Huad, *T. Kokkamhaeng* 34 (BKF, K)]; NORTH-EASTERN: Loei [Phu Kradueng, 13 Mar. 1924, *A.F.G. Kerr* 8686 (BM, K, P); 18 Mar. 1958, *Th. Sørensen et al.* 2242 (C); 17 Mar. 1974, *C. Chermsirivathana & T. Boonkerd* 1857 (BK); 13 Nov. 2004, *P. Traiperm* 162 (BCU, BKF, KKU); 27 Mar. 2006, *P. Traiperm* 377 (BCU, BKF, KKU)]; EASTERN: Si Sa Ket [Kanthararom, 6 Apr. 1954, *T. Smitinand* 591 (BKF)].

Distribution.— Endemic to Thailand.

Ecology.— Dry dipterocarp forest, at 450-1800 m altitude. Flowering in November to May.

2. Eremochloa bimaculata Hack. in DC. Monogr. Phan. 6: 265. 1889.— Type: India, East Bengal, *Griffith* 6774 (holotype B†, isotypes G, K!, frag. in L).

Perennial grass, tufted, slender rhizomatous, cataphylls glabrous. *Culms* erect, 20–60 cm tall, extravaginal branching at base, internodes glabrous, nodes glabrous. *Leaf-sheaths* loose, 3.5–7 cm long, glabrous. *Ligules* an ecilate membrane, *ca.* 0.5 mm long. *Leaf-blades* flat, 4–12 by 0.2–0.4 mm, glabrous on both surfaces, acute at apex. *Inflorescence* racemes, 1–3 together, straight, 5–8 cm long, rachis internodes clavate, 2–2.5 mm long, 0.45–0.5 length of sessile spikelets, glabrous, joints at base glabrous to slightly with a ring short ciliate hairs. *Sessile spikelets*; lower glume oblong, 4.5–5 by 2 mm, distinctly 5–7-nerved, glabrous on the back, setae straight, terete, longest ones 1.5 mm long, shorter than the width of the lower glume, apex with moderately green apical wings, 0.2–0.3 length of the lower glume; upper glume oblong, *ca.* 4.5 by 1.5 mm, 3-nerved, keeled in the middle in the lower half and along the margins, distally with transverse veinlets, glabrous on the lower part of the back,

margins folded. *Lower floret*; lemma oblong, *ca.* 4 by 1 mm long, hyaline, margins folded, ciliate along the upper margins; palea oblong, *ca.* 2.5 by 1 mm, hyaline. *Upper floret*; lemma oblong, *ca.* 3 by 0.8 mm, hyaline; palea oblong, smaller than the lemma, hyaline. *Lodicules* cuneate *ca.* 0.5 mm long. *Anthers* brown, *ca.* 1.5 mm long. Ovary elliptic, *ca.* 1.5 mm long. *Stigmas* purplish. *Pedicelled spikelet* absent. *Pedicels* oblique-obovate with short cordate at the apex, foliose, 4–4.5 mm long, 0.75–0.85 times as long as the sessile spikelet (Figs. 5.8F-J & 5.34D-F).

Thailand.—NORTHERN: Chiang Mai [near Fang, 25 May 1958, *Th. Sørensen et al.* 3583 (BKF)]; EASTERN: Surin [Kap Choeng, 20 May 1965, *S. Sutheesorn* 293 (BK); Thung Kula Rong Hai, 8 Sept. 1970, *S. Sutheesorn* 2113 (BK)], Roi Et [Mueang, 1 Aug. 2004, *P. Traiperm* 116 (BCU, BKF, KKU); Suwannaphum, 22 Oct. 2005, *P. Traiperm* 229 (BCU, BKF, KKU); Kaset Wisai, Ban Wa Ngarm, 9 Jun. 1982, *Y. Paisooksantivathana & S. Sutheesorn* y 982-82 (BK)], Si Sa Ket [Dongrak Range, at Chong Bat Lak, 19 Aug. 1976, *J.F. Maxwell* 76-561 (BK, L)], Ubon Ratchathani [Sirindhorn, 23 Oct. 2005, *P. Traiperm* 254 (BCU, BKF, KKU)]; SOUTH-WESTERN: Prachuap Khiri Khan [Sam Roi Yot, 8 Jul. 1926, *A.F.G. Kerr* 10902, (BM, K)]; SOUTH-EASTERN: Sa Kaeo [Aranyaprathet, 9 Aug. 1930, *A.F.G. Kerr* 19583 (BM, K)].

Distribution.— Burma, Thailand, Cambodia, Vietnam, China, Malesia and Australia.

Ecology.— Grass common in dry dipterocarb forest, at altitude 50-650 m. Flowering in May to September.

Vernacular.— Ya hang nok yung (หญ้าหางนกยูง) (Si Sa Ket).

Notes.— *Eremochloa bimaculata* is usually misidentified as *E. mawellii*, but it is different from the latter species in having an oblique-obovate pedicels with short cordate at the apex, while oblique-lanceolate pedicels in *E. maxwellii*.

3. Eremochloa ciliaris (L.) Merr., Philipp. J. Sci. 1, Suppl.: 331. 1906.

Nardus ciliaris L., Sp. Pl.: 53. 1753. — Type: *Herb. Linn.* 73.7 (lectoype LINN!).

E. horneri Buse in Miq., Pl. Jungh. 3: 357. 1854.— Type: *Horner* 137 (holotype L!, phototype BRI, K!).

E. leersioides (Munro) Hack. in DC., Monogr. Phan. 6: 264. 1889.— Type: *C. Wright* s.n. (holotype K!, isotype P!).

E. falcata Hack. in DC., Monogr. Phan. 6: 263. 1889.— Type: *Meyen* s.n. (holotype B†).

E. malayana Ridl., Mat. Fl. Malay Penins. 3: 155. 1907.— Type: *Ridley* 5154 (holotype SING, isotypes BM!, K!).

E. leersioides (Munro) Hack. var. *gigantean* A. Camus, Notul. Syst. (Paris) 3: 87. 1914.— *E. ciliaris* (L.) Merr. var. *gigantean* A. Camus, Fl. Indo-Chine 7: 291. 1922.— Type: Vietnam, *Eberhardt* 1890 (holotype P!, syntype K!).

E. leersioides (Munro) Hack. var. *pygmaea* A. Camus, Notul. Syst. (Paris) 3: 87. 1914.— *E. ciliaris* (L.) Merr. var. *pygmaea* A. Camus, Fl. Indo-Chine 7: 291. 1922.— Type: *Bauche* 97 (holotype P!).

E. leersioides (Munro) Hack. var. *thorelii* A. Camus, Notul. Syst. (Paris) 3: 87. 1914.— *E. ciliaris* (L.) Merr. var. *thorelii* A. Camus, Fl. Indo-Chine 7: 291. 1922.— Type: *Thorel* s.n. (holotype P!).

E. ciliaris (L.) Merr. var. *elata* Reeder, J. Arnold Arbor. 29: 351. 1948.— Type: *Brass* 7808 (holotype US).

Perennial grass, tufted, rhizomatous, cataphylls glabrous to pilose. *Culms* erect, 25–45 cm tall, extravaginal branching at base, internodes glabrous to pilose, nodes glabrous to slightly pilose. *Leaf-sheaths* loose, 2–10 cm long, glabrous, margins thin. *Ligules* membranous, 0.4–1 mm long. *Leaf-blades* flat to slightly folded, 3–15 cm by 2.5–8 mm, glabrous to sparsely hairy on both surfaces, margins thick and scabrous, acute at apex. *Inflorescence* racemes, 1–3 together, falcate, 1–5 cm long, rachis internodes clavate, 1.8–2.5 mm long, 0.5–0.6 length of sessile spikelets, pilose, joints at base with short ciliate hairs. *Sessile spikelets*; lower glume ovate, 4–4.5 by 1.8–2 mm, obscurely 4–7-nerved, glabrous to densely hairy on the back, setae straight, flattened, longest ones 3–3.5 mm long, much longer than of the width of the lower glume, apex wingless; upper glume oblong to elliptic, 3.8–4.2 by *ca.* 1 mm, 3-nerved, keeled in the middle in the lower half and along the margins, distally with transverse veinlets, slightly appressed hairs on the lower part of the back, margins folded. *Lower floret*; lemma elliptic, *ca.* 3 by 0.8 mm, margins folded, hyaline; palea oblong, *ca.* 2.8 by 0.8 mm, hyaline. *Upper floret*; lemma oblong, *ca.* 2.8 by 0.8 mm, hyaline; palea oblong, *ca.* 2.5 by 0.5 mm, hyaline. *Lodicules* cuneate *ca.* 0.5 mm long.

Anthers brown, *ca.* 2–2.5 mm long. Ovary ovoid, *ca.* 1.5 mm long. *Stigma* purplish. *Pedicelled spikelet* absent. *Pedicels* subulate, *ca.* 2-3 mm long, 0.5–0.75 times as long as the sessile spikelet, glabrous to slightly pilose (Figs. 5.8K-N & 5.35A-D).

Thailand.— NORTHERN: Mae Hong Son [Lang Mee, 7 Aug. 1958, *T. Smitinand* 4583 (BKF)], Chiang Mai [Doi Suthep, 30 Jul. 1911, *A.F.G. Kerr* 1938 (BM, E, K, TCD); 4 Aug. 1912, *A.F.G. Kerr* 2651 (BM, K); 17 Sept. 1958, *Th. Sørensen et al.* 5046 (C, K); Op Luang, along road from Bo Luang to Om Koi, 12 Jun. 1968, *C.F. van Beusekom & C. Phengklai* 1183 (BKF, L); 2 stops on road to Om Koi, 23 Feb. 1979, *T. Koyama et al.* 15,523 (AAU); Mae Rim, 21 Jul. 1996, *M. Norsaengsri* 309 (QBG)], Phitsanulok [Phu Miang mountain, 28 Jul. 1966, *K. Larsen* 992 (AAU, K); Phu Hin Rong Ka, 29 Oct. 2001, *S. Watthana & P. Suksathan* 1574 (QBG); 29 Mar. 2006, *P. Traiperm* 380 (BCU, BKF, KKU), 381, 382 (BCU, BKF, KKU), 383 (BCU, BKF, KKU)], Nakhon Sawan [31 km N of Nakhon Sawan, 6 Feb. 1959 (BKF, K), *T. Smitinand* 5804 (BKF)]; NORTH-EASTERN: Loei [Phu Luang, 17 Nov. 1968, *C. Chermsirivathana* 1139 (BK); Phu Kradueng, 21 Mar. 1958, *Th. Sørensen et al.* 2399 (K), 23 Mar. 1954, *T. Smitinand* 1796 (BKF); 18 Mar. 1958, *Th. Sørensen et al.* 2242 (BKF, K), 21 Mar. 1958, 2399 (C, E, K); 7 Mar. 1909, *P.J. O' Connor & C. Niyomdham* 15,672 (AAU, BKF); Phu Ruea, 23 May 2004, *P. Traiperm* 119; 4 Dec. 2004, *P. Traiperm* 190 (BCU, BKF, KKU)], Udon Thani [Mueang, 10 Oct. 2004, *P. Traiperm* 130 (BCU, BKF, KKU)], Nong Khai [Chaiyaburi, 1 May 1932, *A.F.G. Kerr* 21328 (BK, BM, K); Phu Woe, 16 Oct. 2005, *P. Traiperm* 216 (BCU, BKF, KKU)], Sakon Nakhon [Phu Phan National Park, 21 Jul. 1999, *S. Vessabutr et al.* 845 (QBG)]; Nakhon Phanom [Tha Uthen, 16 Feb. 1924, *A.F.G. Kerr* 8465 (BK, BM, K, P, TCD); 8 Dec. 1963, *Pradit* 428 (BKF)]; EASTERN: Chaiyaphum [Phu Khiao, 14 Aug. 1972, *K. Larsen et al.* 31819 (AAU, BKF, K, L)], Surin [near Cambodian border, *ca.* 5 km N of Sangkha, 6 Oct. 1984, *G. Murata et al.* T-37709 (BKF, L)], Roi Et [Thung Kula Rong Hai, 22 Jun. 1969, *T. Smitinand* 10746 (BKF, L)], Si Sa Ket [2 km N of Chong Bat Lak, Kantharalak, 12 Apr. 1976, *J.F. Maxwell* 76-222 (AAU, BK, L)], Ubon Ratchathani [Khong Chiam, Huai Yang, *J.F. Maxwell* 01-405, 14 Sept. 2001 (BKF)]; SOUTH-WESTERN: Uthai Thani [Huai Kha Khaeng Reserve, Ban Rai, 22 Apr. 1976, *J.F. Maxwell* 76-265 (AAU, BK, L); Khao Phetawee, 28 Jun. 1999, *M. Norsaengsri* 819 (QBG)], Kanchanaburi [Ban Kao, 11 Nov. 1961, *K. Larsen* 8138 (C,K)], Ratchaburi [Huai Yang, 9 Aug. 1966, *K. Larsen* et

al. 1330 (AAU, BKF, K)], Phetchaburi [Thung Luang, 9 Nov. 1931, *A.F.G. Kerr* 20609 (BK, BM, K)], Prachuap Khiri Khan [Sam Roi Yot, 8 Dec. 26, *A.F.G. Kerr* 10902 (BK, BM, K); 23 Oct. 1964, *C. Chermsirivathana* 146 (BK)]; SOUTH-EASTERN: Sa Kaeo [Aranyaprathet, 9 Aug. 1930, *A.F.G. Kerr* 19583 (BK, K); Nang Wiang, 8 Jun. 1953, *K. Suvathabhandhu* 456 (BKF)], Prachin Buri [Prachantakham, 2 Jan. 1967, *S. Sutheesorn* 2042 (BK)], Chon Buri [Khao Khiao, 23 Jun. 1975, *J.F. Maxwell* 75-617 (AAU, BK, L)], Chanthaburi [Plain of Makham, 14 Sept. 1956, *T. Smitinand* 3506, 9 Apr. 1959, 5760 (BKF, K); 6 Jun. 1963, *K. Larsen* 9787 (C); 13 Jun. 1963, 10030 (BKF, C, K, L), 10067 (C, K), 10067a (BKF, K)], Trat [Saphan Hin, 3 May 1974, *R. Geesink et al.* 6518 (BKF, C, K, L)]; PENINSULAR: Chumphon [Ban Huai Keaw, Tungka, Mueang, 15 Jan. 1987, *J. Supapol* 217 (CMU, PSU)], Surat Thani [Kanchanadit, 1 Aug. 1927, *A.F.G. Kerr* 13073 (BK, BM, K); Kanthuli, 6 Sept. 1931, *A.F.G. Kerr* 4120 (BK, BM, K); 29 May 1960, *C. Chataraprasong* 106 (BK)], Phatthalung [Sak, 1 May 1930, *A.F.G. Kerr* 19273 (BK, BM, K)], Trang [Bangsak, 20 Apr. 1930, *A.F.G. Kerr* 19044 (K), 19046 (BK, BKF, BM, K, P); Sikao, ex Hat Chao Mai National Park, *Y. Paisooksantivathana* y 2424-89, (BK)], Satun [28 Dec. 1927, *A.F.G. Kerr* 13716 (BK, BM, K); Butang, 13 Jan. 1928, *A.F.G. Kerr* 14052 (BKF, BM, K); Thung Nui, 13 Feb. 1961, *T. Smitinand* 7160 (BKF)], Songkhla [8 Apr. 1918, *A.F.G. Kerr* 15754 (K); Khao Khiao, 28 Jul. 1928, *A.F.G. Kerr* 15960 (BK, BM, K); 2 Nov. 1982, *Chorthip* 42 (PSU); Ton Nga Chang water falls, 13 Aug. 1984, *J.F. Maxwell* 84-54 (PSU); 1 Nov. 1990, *K. Larsen et al.* 41069 (AAU, BKF, PSU); 21 Aug. 1992, *C. Niyomdham & P. Pudjaa* 3142 (BKF); Ban Bak Bang, Thepa, 26 Jun. 1985, *J.F. Maxwell* 85-641 (AAU, BKF, L, PSU); Khlong Hoi Khong, 10 km W of Toong Loong, Hat Yai, 31 Oct. 1986, *J.F. Maxwell* 86-848 (BKF, CMU, L, P, PSU)], Pattani [17 Jul. 1923, *A.F.G. Kerr* 7243 (BK, BM, K)], Narathiwat [Mueang, 17 Dec. 1986, *J.F. Maxwell* 86-1082 (BKF, CMU, L, PSU), Ban Thorn, 29 Aug. 1989, *C. Niyomdham* 2019 (BK); Talingchan, Bannangsata, 6 Aug. 2000, *C. Niyomdham et al.* 6349 (AAU)].

Distribution.— Burma, Laos, Vietnam, China, Taiwan, Singapore, Malesia and Australia.

Ecology.— In deciduous, dipterocarp or pine forest, up to 2,200 m altitude. Flowering throughout the year.

Notes.— This species has a wide variability in the lower gume of the sessile spikelet.

4. Eremochloa ciliatifolia Hack. in DC., Monogr. Phan. 6: 265. 1889.— Type: India, East Bengal, *Griffith* KD 6776 (holotype B, isotypes E!, K!, L!, MO, US).

Annuals grass, tufted, cataphylls with appressed hairs but woolly at base. *Culms* erect, 30–70 cm tall, extravaginal branching at base, internodes pilose, nodes with long ciliate hairs. *Leaf-sheaths* loose, 4–12 cm long, with slightly pilose hairs to densely pilose hairs. *Ligules* membranous with ciliate margins, *ca.* 0.35–0.4 mm long. *Leaf-blades* flat to slightly folded, 5–25 cm by 2–5 mm, obtuse to acute at apex, glabrous to densely hairs on both surfaces, margins pilose. *Inflorescence* racemes, 1–3 together, straight, 3–7 cm long, rachis internodes clavate, *ca.* 2 mm long, 0.4–0.45 length of sessile spikelets, scabrous, joints at base with long ciliate hairs. *Sessile spikelets*; lower glume oblong-ovate, 4–4.7 by *ca.* 2 mm, distinctly 6–9-nerved, with appressed hairs on the back, setae straight, terete, longest ones 3.2–3.5 mm long, much longer than of the width of the lower glume, apex wingless; upper glume elliptic, 4.2–4.5 by 1.2–1.4 mm, 3-nerved, keeled in the middle in the lower half and along the margins, with distally transverse veinlets, appressed hairs on the lower part of the back, margins folded. *Lower floret*; lemma oblong-ovate, *ca.* 4 by 1 mm, hyaline, margins folded; palea elliptic, *ca.* 3.5 by 0.8 mm, hyaline. *Upper floret*; lemma elliptic, *ca.* 3 by 0.8 mm, hyaline; palea oblong, *ca.* 3 by 0.5 mm, hyaline. *Lodicules* cuneate *ca.* 0.6 mm long. *Anthers* brown, *ca.* 3 mm long. *Ovary* elliptic, 1.8–2 mm long. *Stigmas* purplish. *Pedicelled spikelet* reduced to subulate, 0.8–1.3 mm long, pilose. *Pedicels* obovate with long cordate apex, 2.2–2.4 mm long, 0.5 times as long as the sessile spikelet (Figs. 5.9A-C & 5.35E-G).

Thailand.— NORTH-EASTERN: Phetchabun [Tung Salaeng Luang, 2 Oct. 1964, *B. Hansen et al.* 11104 (BKF, C, L)], Loei, [Phu Kradueng, 31 Aug. 1988, *H. Koyama* T-61479 (AAU, L); 13 Nov. 2004, *P. Traiperm* 163 (BCU, BKF, KKU); 29 Oct. 2005, *P. Traiperm* 261 (BCU, BKF, KKU), 264 (BCU, BKF, KKU), 266 (BCU, BKF, KKU), 267 (BCU, BKF, KKU); 30 Oct. 2005, *P. Traiperm* 268 (BCU, BKF, KKU), 269 (BCU, BKF, KKU), 270 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [Phu Khiao, 24 Feb. 1931, *A.F.G. Kerr* 20256 (BK, BM, K)]; SOUTH-EASTERN: Trat [4 May 1974, *J.F. Maxwell* 74-358 (AAU, BK)].

Distribution.— Burma and Vietnam.

Ecology.— Grassland, dipterocarp woodland and pine forests at 250–1,300 m altitude. Flowering between May and November.

Notes.— This species is similar to *E. ciliaris* in having wingless, but differs in the shape of the pedicels.

5. Eremochloa eriopoda C.E. Hubbard in Hook., Icon. Pl. 34: t 3376. 1939.— Type: Thailand, Ubon Ratchathani: Muang Samsip, *A.F.G. Kerr* 8354 (holotype K!, isotypes BK!, BM!, TCD!).

Perennial grass, tufted; cataphylls with woolly hairs. *Culms* erect, up to 1 m tall, extravaginal branching at base, internodes glabrous to densely hairs, nodes with long ciliate hairs. *Leaf-sheaths* loose, 5–8 cm long, glabrous to slightly pilose, margins with sparse hairs. *Ligules* ciliate, *ca.* 0.35–0.4 mm long. *Leaf-blades* flat to slightly folded, up to 45 cm by 3–4 mm, glabrous to densely hairy on both surfaces, margins glabrous to pilose, usually wooly hairy at base, acute at apex. *Inflorescence* racemes, 1 to several, falcate, 2–4.5 cm long, rachis internodes clavate, 1.5 mm long, *ca.* 0.35 length of sessile spikelets, scabrous, joints at base with long ciliate hairs. *Sessile spikelets*; lower glume oblong-ovate to ovate, 4.5–5 by 1.8–2 mm, obscurely 5–6-nerved, glabrous to densely hairy on the back, setae straight, flattened, longest ones 4–4.5 mm long, much longer than of the width of the lower glume, apex wingless; upper glume elliptic, 4.5–5 by 1–1.2 mm, 3-nerved, keeled in the middle in the lower half and along the margins, without distally with transverse veinlet, densely hairy on the lower part of the back, margins folded. *Lower floret*; lemma elliptic, *ca.* 4 by 1 mm long, hyaline, margins folded; palea elliptic, *ca.* 3.5 by 1 mm, hyaline. *Upper floret*; lemma oblong, *ca.* 3.5 by 1 mm, hyaline, margins folded; palea oblong, *ca.* 3.2 by 0.8 mm, hyaline. *Lodicules* cuneate, *ca.* 0.6 mm long. *Anthers* brown, *ca.* 3 mm long. *Ovary* elliptic, *ca.* 2 mm long. *Stigmas* purplish. *Pedicelled spikelet* absent. *Pedicels* subulate, 6–7 mm long, 1.45–1.5 times as long as the sessile spikelet (Figs. 5.9D-G & 5.36A-C).

Thailand.— NORTH-EASTERN: Nong Khai [Na Nok, Phon Phisai, *Adisai* 518, 6 Jun. 1963 (BK); Bueng Karn, Huai Poo, 17 Nov. 1966, *T. Smitinand* 10094 (BKF, L); Si Chiang Mai, 18 Aug. 1972, *T. Smitinand* 11646 (BKK), 11647A (K)], Mukdahan [Mukdahan National Park (Phu Pha Thueb), 23 Aug. 2001, *R. Pooma et al.*

2437 (BKF, L); 9 Oct. 2006, *P. Traiperm* 374 (BCU, BKF, KKU)]; EASTERN: Si Sa Ket [en route from Srisaket to Kantharalak about 10 km from Kantharalak, 8 Oct. 1984, *G. Murata et al.* T-49670 (BKF, L); Near cambodian border, 20 km s of Kantharalak, 8 Oct. 1984, *G. Murata et al.* T-49673 (BKF, L); *G. Murata et al.* T-49675 (BKF, L); Dongrak range, 31 Dec. 2005, *P. Traiperm* 362 (BCU, BKF, KKU); Khao Phra Wihan, 31 Dec. 2005, *P. Traiperm* 365 (BCU, BKF, KKU), 366 (BCU, BKF, KKU)], Ubon Ratchathani [Muang Sam Sip, 26 Jan. 1924, *A.F.G. Kerr* 8354 (BK, BM, K, TCD); Warin Chamrap, *S. Laegaard et al.* 21832 (AAU, K, L), 21847 (AAU, K, L); Pa Dong Na Tham, Khong Chiam, *C. Niyomdham* 5628 (AAU); km 81, 217 road, 22 Oct. 2005, *P. Traiperm* 237 (BCU, BKF, KKU); km 10, 2112 road to Khong Chiam, 23 Oct. 2005, *P. Traiperm* 253 (BCU, BKF, KKU); Pha Taem National Park, 23 Oct. 2005, *P. Traiperm* 243 (BCU, BKF, KKU), 246 (BCU, BKF, KKU), 247 (BCU, BKF, KKU), 248 (BCU, BKF, KKU); Phu Chong Na Yoi, 24 Oct. 2005, *P. Traiperm* 255 (BCU, BKF, KKU)].

Distribution.— Laos, Vietnam and Malesia.

Ecology.— In sandy soid on open rocky area in dry deciduous or diptercarp forest, at 0-210 m altitude. Flowering in August to January.

Notes.— This species very similar to *E. ciliatifolia* in having wingless in the lower glume of sessile spikelet, but differs in the shape of pedicels.

6. Eremochloa lanceolata Buitenhuis in Blumea 46 (2): 409. 2001.— Type: Thailand, Pha Taem National Park: Ubon Ratchathani, *Nanakorn* 1253 (holotype NY!, isotype BKF!).

Annuals grass, tufted, cataphylls glabrous. *Culms* erect, 20–40 cm tall, extravaginal branching at base, internodes glabrous, nodes glabrous or slightly long pilose. *Leaf-sheaths* loose, 3–6 cm long, glabrous. *Ligules* an eciliate membrane, 0.8–1 mm long. *Leaf-blades* slightly folded, 3–6 cm by 2–3 mm, glabrous or slightly pilose on both surfaces, margins pilose, acute at apex. *Inflorescence* racemes, 1–3, straight to slightly falcate, 2.5–3.5 cm long, rachis internodes clavate, 2–2.3 mm long, 0.4–0.5 length of sessile spikelets, scabrous, jointed at base with long ciliate hairs. *Sessile spikelets*; lower glume ovate, 4–4.5 by 1–1.5 mm, obscurely 5–7-nerved, glabrous to slightly appressed hairy on the back, setae straight, terete, longest ones 2.8–3 mm long, much longer than of the width of the lower glume, apex wingless;

upper glume oblong, 3–4 by 0.8–1 mm, 3-nerved, keeled in the middle in the lower half and along the margins, without distally with transverse veinlet, glabrous on the back, margins folded, scabrous along margins. *Lower floret*; lemma oblong-ovate, *ca.* 2.8 mm long, hyaline, margins folded; palea smaller than lemma, *ca.* 2.8 mm long, hyaline. *Upper floret*; lemma elliptic, *ca.* 2 mm long, hyaline, margins folded; palea smaller than lemma, *ca.* 2 mm long, hyaline. *Lodicules* cuneate, 0.4 mm long. *Anthers* brown, 1.8–2 mm long. *Ovary* elliptic, *ca.* 1.5 mm long. *Stigmas* purplish. *Pedicelled spikelet* absent. *Pedicels* subulate, 5.5–6.5 mm long, 1.5 times as long as the sessile spikelet (Figs. 5.9H-J & 5.36D-F).

Thailand.—EASTERN: Nakhon Ratchasima [Khao Kuap, 25 Dec. 1919, *A.F.G. Kerr* 17762 (BM, K)]; Ubon Ratchathani [Pha Taem National Park, *Nanakorn* 1253, (BKF, NY); 23 Oct. 2005, *P. Traiperm* 242 (BCU, BKF, KKU); km 81 on road 217 E of Warin Chamrap, 27 Oct. 2001, *S. Laegaard et al.* 21828 (AAU), 21831 (AAU, K, L), 21835 (AAU), 21843 (AAU); 22 Oct. 2005, *P. Traiperm* 236 (BCU, BKF, KKU)].

Distribution.— Endemic to Thailand

Ecology.— Secondary grassland, sandstone forest or edge of dry dipterocarp forest at *ca.* 125 m altitude. Flowering in October.

Notes.— This species has a tiny inflorescence and similar to *E. eriopoda* in having subulate pedicel, but differs in its shape and the length of setae. *Eremochloa lanceolata* having a straight setae, terete, and the longest ones 2.8–3 mm long, whereas setae straight, flattened, and a longest ones 4–4.5 mm long in *E. eriopoda*.

7. Eremochloa maxwellii Veldkamp in Blumea 48 (3): 496. 2003.— Type: Thailand, Ubon Ratchathani: km 36 on road 217 E of Warin Chamrap, *S. Laegaard et al.* 21811, (holotype AAU!).

Perennial grass, tufted, slender rhizomatous, cataphylls glabrous. *Culms* erect, up to 80 cm tall, extravaginal branching at base, internodes glabrous, nodes glabrous. *Leaf-sheaths* loose, 3–9 cm long, glabrous. *Ligules* an ecilate membrane, 0.35–0.4 mm long. *Leaf-blades* flat to slightly folded, 5–20 cm long, 2–4 mm, glabrous on both surfaces, acute at the apex. *Inflorescence* racemes, 1–3 together, straight, 5–11 cm long, rachis internodes clavate, 2–2.3 mm long, 0.45–0.65 length of sessile spikelets,

glabrous, jointed at base with short ciliate hairs. *Sessile spikelets*; lower glume oblong-ovate, 3.5–5 by 1.2–1.5 mm, obscurely 6–8-nerved, glabrous on the back, setae straight, terete, longest ones 2.5–3 mm long, much longer than the width of the lower glume, apex with a moderately green apical wings, 0.2–0.3 length of the lower glume; upper glume oblong, *ca.* 3.5 by 1.5 mm, 3-nerved, keeled in the middle in the lower half and along the margins, distally with transverse veinlets, glabrous on the lower part of the back, margins folded. *Lower floret* lemma elliptic, *ca.* 3 by 1 mm, hyaline, margins folded; palea elliptic, *ca.* 3 by 0.8 mm, hyaline. *Upper floret*; lemma elliptic, *ca.* 3 by 1 mm, hyaline; palea elliptic, *ca.* 2.8 by 0.8 mm, hyaline. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers* brown, *ca.* 1.6 mm long. *Ovary* elliptic, *ca.* 1.5 mm long. *Stigmas* purplish. *Pedicelled spikelet* absent. *Pedicels* oblique-lanceolate, foliose, 3.5–5.5 mm long, 0.7–1 times as long as the sessile spikelet (Figs. 5.10A-C & 5.37A-C).

Thailand.— EASTERN: Si Sa Ket [Dongrak, Kantharalak, 19 Aug. 1976, *J.F. Maxwell* 76-561 (AAU, BK)]; Ubon Ratchathani [km 36 on road 217 E of Warin Chamrap, 27 Oct. 2001, *S. Laegaard et al.* 21811 (AAU); 22 Oct. 2005, *P. Traiperm* 232 (BCU, BKF, KKU)].

Distribution.— Endemic to Thailand.

Ecology.— Secondary grassland in deciduous forest, at altitude *ca.* 125 m. Flowering in October.

Notes.— This species is very similar to *E. bimaculata* in having 2 apical wings, but differs in it shape of pedicels. Pecicels oblique-lanceolate, foliose, 3.5–5.5 mm long in *E. mawellii*, while oblique-obovate with short cordate at apex, foliose, 4–4.5 mm long in *E. bimaculata*.

8. Eremochloa muricata (Retz.) Hack. in DC., Monogr. Phan. 6: 262. 1889.

Aegilops muricata Retz., Observ. Bot. 2: 27. 1781. — Type: *König* s.n. (holotype K!, isotypes C, LD).

Rottboellia muricata Retz., Observ. Bot. 3: 12. 1783.

Aegilops ciliaris Koen. ex Roem. & Schult., Syst. 2: 772.— Type: India (isotype K!).

Perennial grass, tufted, slender rhizomatous, cataphylls woolly. *Culms* erect, 30–45 cm tall, extravaginal branching at base, internodes glabrous, nodes slightly pilose. *Leaf-sheaths* loose, 5–8 cm long, glabrous to pilose. *Ligules* membranous with ciliate margins, *ca.* 1–1.5 mm long. *Leaf-blades* flat to slightly folded, 6–15 cm long, 4–5 mm wide, glabrous on both surfaces, margins entire or pilose, acute at the apex. *Inflorescence* racemes, 1–2, straight, 4–6 cm long, rachis internodes clavate, 3–3.2 mm long, about 0.5 length of sessile spikelets, glabrous, jointed at base glabrous *Sessile spikelets*; lower glume elliptic, *ca.* 6 by 2 mm, distinctly 4–7-nerved, glabrous on the back, setae straight, terete, longest ones *ca.* 2 mm long, as long as the width of the lower glume, apex with large apical wings, 0.4 length of the lower glume; upper glume elliptic, 5–5.5 by *ca.* 1.2 mm, 3-nerved, keeled in the middle in the lower half and along the margins, without distally with transverse veinlet, with sparse short hairs on the lower part of the back, margins folded. *Lower floret*; lemma elliptic, *ca.* 4.5 by 1 mm, hyaline, margins folded; palea elliptic, *ca.* 5 by 0.8 mm, hyaline, slightly folded. *Upper floret*; lemma elliptic, *ca.* 3.5 by 0.8 mm, hyaline, folded; palea oblong, *ca.* 4 by 0.5 mm, hyaline, margins folded. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers* brown, *ca.* 2–2.5 mm long. *Ovary* ovoid, *ca.* 1 mm long. *Stigmas* purplish. *Pedicelled spikelet* absent. *Pedicels* obliquely obovoid, 5–5.5 mm long, 0.9–0.95 times as long as the sessile spikelet (Figs. 5.10D-F & 5.37D. & E).

Thailand.— NORTH-EASTERN: Sakon Nakhon [Ban Thom, 12 Sept. 1962, *A. Chantanamuck* 250 (BKF)]; SOUTH-WESTERN: Ratchaburi [18 Jul. 1924, *A. Marcan* 1786 (BM, K); 1790 (K); 18 Jul. 1924, *A.F.G. Kerr* 9033 (BK, BM, K)], Phetchaburi [Thung Luang, 10 Nov. 1931, *A.F.G. Kerr* 20627 (BKF, BM, K)], Prachuap Khiri Khan [Hua Hin, 6 Nov. 1927, *A.F.G. Kerr* 13459 (BKF, BM)].

Distribution.— India, Indo-China, Australia.

Ecology.— Growing on an open sandy soil in deciduous forest, at 0-50 m altitude. Flowering in July to November.

Notes.— *Eremochloa muricata* differs from other *Eremochloa* in having a large apical wings on lower glume of sessile spikelet.

9. Eremochloa petelotii Merr., Univ. Calif. Publ. Bot. 10 (9): 423. 1924.— Type: Vietnam: Tonkin, *M. Pételot* 247 (holotype UC, isotype P!, phototype K!, P!, fragm. in A, US).

Perennial grass, tufted, cataphylls glabrous. *Culms* erect, up to 1 m tall, extravaginal branching at base, internodes glabrous, nodes glabrous. *Leaf-sheaths* loose, 3–8 cm long, glabrous. *Ligule* ciliate, 0.35–0.40 mm long. *Leaf-blades* flat, up to 45 cm, 0.7–1 cm, glabrous on both surfaces, margins scabrous, acute at the apex. *Inflorescence* racemes, solitary, straight, 3–10 cm long, rachis internodes clavate, 2.5–3 mm long, *ca.* 0.4 length of sessile spikelets, glabrous, jointed at base glabrous or glabrescent. *Sessile spikelets*; lower glume ovate, 5–5.5 by *ca.* 1.5 mm, distinctly 3–6-nerved, glabrous on the back, setae hook-like, terete, longest ones *ca.* 0.5 mm long, shorter than the width of the lower glume, apex with a large apical wings, 0.4–0.5 length of the lower glume; upper glume lanceolate, 4.5–5 by *ca.* 0.8 mm, 3-nerved, keeled in the middle in the lower half and along the margins, keeled scabrous, obscurely distally with transverse veinlets, glabrous on the lower part of the back, margins folded. *Lower floret*; lemma elliptic, *ca.* 3.5 by 1 mm, hyaline, margins folded; palea lanceolate, *ca.* 3.5 by 0.5 mm, hyaline. *Upper floret*; lemma oblong, *ca.* 2.8 by 0.5 mm, hyaline; upper palea oblong, *ca.* 2.5 by 0.5 mm, hyaline. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers* brown, *ca.* 1.5 mm long. *Ovary* elliptic, *ca.* 2 mm long. *Stigmas* purplish. *Pedicelled spikelet* absent. *Pedicels* narrowly lanceolate, *ca.* 8–8.5 mm long, *ca.* 1.6 times as long as the sessile spikelet (Figs. 5.10G-I & 5.37F. & G).

Thailand.— EASTERN: Nakhon Ratchasima [Phimai, 27 Dec. 1958, *T. Smitinand* 5045 (BKF, K)], Surin [Thung Kula Rong Hai, Chumphon Buri, 17 Sept. 1972, *S. Sutheesorn* 2315 (BKF)].

Distribution.— Cambodia, Vietnam.

Ecology.— Tufted grass common in paddy field, at *ca.* 250 m altitude. Flowering in September to December.

Notes.— Only known from three collections from two different localities. As the previous data said to be very common in paddy field, however I have not seen in their localities.

10. Eremochloa sp.1

Perennial grass, tufted, slender rhizomatous, cataphylls glabrous. *Culms* erect, 40–100 cm tall, extravaginal branching at base, internodes glabrous, nodes ciliate.

Leaf-sheaths loose, 8–12 cm long, glabrous to hirsute. *Ligules* membranous, ciliate, 1.5–2 mm long. *Leaf-blades* flat, 12–47 cm by 3–5 mm, glabrous on both surfaces, margins scabrous and pilose, 1–2 mm long acute at apex. *Inflorescence* racemes, solitary, straight, 6–8 cm long, rachis internodes clavate, 2–2.3 mm long, 0.45–0.65 length of sessile spikelets, sparsely hairy, jointed at base, glabrous or sparsely hairy. *Sessile spikelets*; lower glume oblong-ovate to ovate, 4.5–5 by 1.5–2 mm, distinctly 7–9-nerved, glabrous on the back, setae straight, terete, longest ones 2–2.5 mm long, as long as the width of the lower glume or sometimes slightly longer than apex with a moderately green apical wings, 0.1–0.3 length of the lower glume; upper glume oblong, *ca.* 3.5 by 1.5 mm, 3-nerved, keeled in the middle in the lower half and along the margins, distally with transverse veinlets, with sparse hairs on the lower part of the back, margins folded. *Lower floret*; lemma oblong, *ca.* 3 by 1 mm long, hyaline, margins folded, ciliate along the upper margins; palea oblong, *ca.* 3 by 0.7 mm, hyaline. *Upper floret*; lemma oblong, *ca.* 2.5–3 by 1 mm, hyaline; palea lanceolate, *ca.* 2.8 by 0.5 mm, hyaline, margins folded. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers* brown, *ca.* 0.8–1 mm long. *Ovary* ovoid, *ca.* 1 mm long. *Stigmas* purplish. *Pedicelled spikelet* absent. *Pedicels* obovate with a long cordate apex, 4.5–6 mm long, 0.9–1.2 times as long as the sessile spikelet (Figs. 5.11 & 5.38A-C).

Thailand.— NORTH-EASTERN: Khon Kaen [Khok Phu Taka, 9 Sept. 2004, *P. Traiperm* 125 (BCU, BKF, KKU); EASTERN: Chaiyaphum [Nong Bua Daeng, 15 Aug. 1972, *K. Larsen et al.* 31871 (AAU, BKF, L)], Nakhon Ratchasima [Huai Thalaeng, 20 Aug. 2001, *R. Pooma et al.* 2118 (BKF, L)].

Distribution.— Endemic to Thailand.

Ecology.— Growing on sandy soil in dipterocarp forest, at *ca.* 300 m altitude. Flowering between August and September.

Notes.— *Eremochloa* sp.1 is similar to *E. maxwellii* but differs considerably in having obovate with a long cordate pedicel, while oblique-lanceolate pedicel in *E. maxwellii*.

11. Eremochloa sp.2

Perennial grass, tufted, slender rhizomatous, cataphylls glabrous. *Culms* erect, 20–30 cm tall, extravaginal branching at base, internodes glabrous, nodes glabrous.

Leaf-sheaths loose, 3.5–7 cm long, glabrous to hirsute. *Ligules* ciliolate, *ca.* 1.5–2 mm long. *Leaf-blades* flat to slightly folded, 3–15 cm by 4–5 mm, glabrous on both surfaces, margins entire, acute at apex. *Inflorescence* racemes, solitary, straight, 3.5–6 cm long, rachis internodes clavate, 3–3.5 mm long, 0.65–0.7 length of sessile spikelets, sparsely hairy, jointed at base glabrous or sparse with a ring of short cilia. *Sessile spikelets*; lower glume oblong, 4–4.5 by *ca.* 1.5 mm, distinctly 4–6-nerved, glabrous on the back, setae straight, terete, longest ones 1.5–1.6 mm long, as long as the width of the lower glume apex with a large apical wings, 0.5–0.6 length of the lower glume; upper glume oblong, 4–4.2 by *ca.* 1 mm, 3-nerved, keeled in the middle in the lower half and along the margins, distally with transverse veinlets, glabrous on the lower part of the back, margins folded. *Lower floret*; lemma oblong, *ca.* 3.8 by 0.8 mm, hyaline, margins folded; palea oblong, *ca.* 3 by 0.5 mm, hyaline. *Upper floret*; lemma oblong, *ca.* 3 by 0.8 mm, hyaline; palea oblong, *ca.* 3.2 by 0.6 mm, hyaline, margins folded. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers* brown, *ca.* 1 mm long. *Ovary* ovoid, *ca.* 1 mm long. *Stigmas* purplish. *Pedicelled spikelet* absent. *Pedicels* subulate, slightly expanded and foliose on the lower part, 7–7.5 mm long, 1.7–1.8 times as long as the sessile spikelet (Figs. 5.12A-C & 5.38D-F).

Thailand.— NORTH-EASTERN: Loei [Phu Kradueng: near Wang Kwang waterfalls, 29 Oct. 2005, *P. Traiperm* 260 (BCU, BKF, KKU)]

Distribution.— Endemic to Thailand.

Ecology.— Growing on the rock near stream, at *ca.* 1,300 m altitude. Flowering in October.

Notes.— *Eremochloa* sp.2 resembles *E. muricata*, but can be distinguished from the latter in having a subulate pedicel, while an obliquely obovoid pedicel in *E. muricata*.

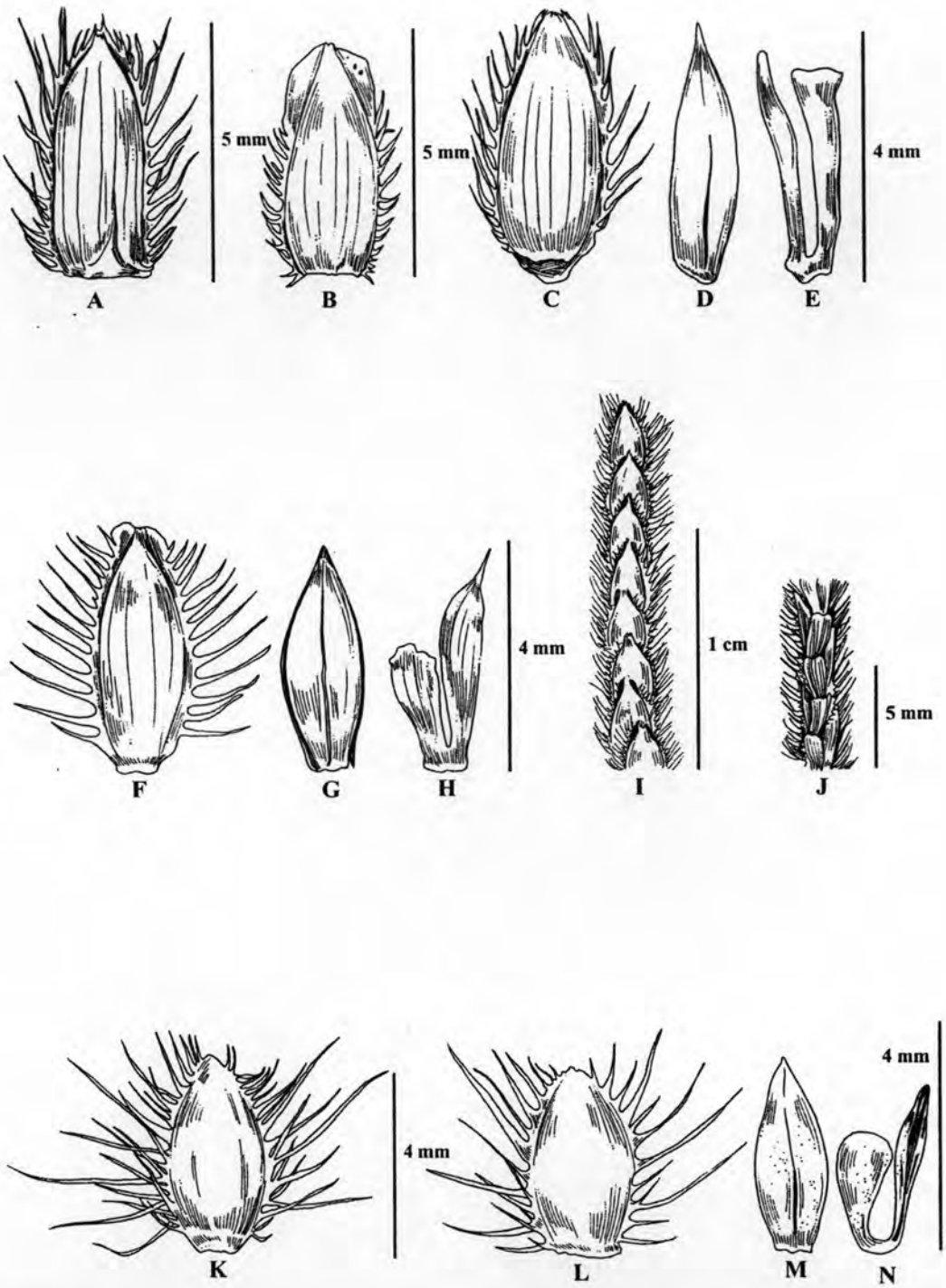

Figure 5.8 A-E. *Eremochloa attenuata*: A-C. lower glume of the sessile spikelet; D. upper glume of the sessile spikelet; E. pedicelled spikelet with rachis joint. F-J. *E. bimaculata*: F. lower glume of the sessile spikelet; G. upper glume of the sessile spikelet; H. pedicelled spikelet with rachis joint; I. & J. two views of partial raceme. K-N. *E. ciliaris*: K. & L. lower glume of the sessile spikelet; M. upper glume of the sessile spikelet; N. pedicelled spikelet with rachis joint.

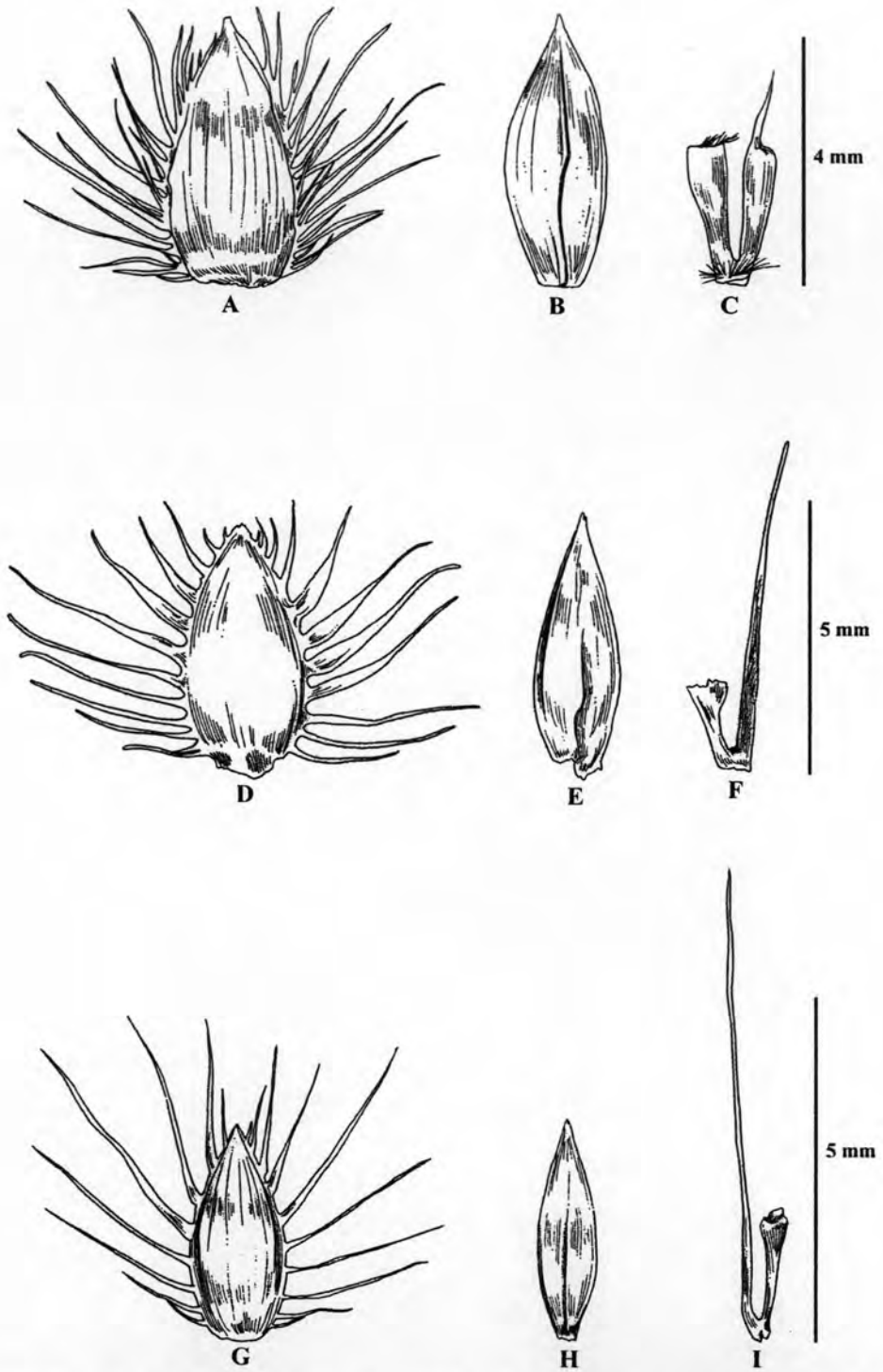

Figure 5.9 A-C. *Eremochloa ciliatifolia*: A. lower glume of the sessile spikelet; B. upper glume of the sessile spikelet; C. pedicelled spikelet with rachis joint. D-G. *E. eriopoda*: D. lower glume of the sessile spikelet; E. upper glume of the sessile spikelet; F. pedicelled spikelet with rachis joint; G. spikelet pair. H-J. *E. lanceolata*: H. lower glume of the sessile spikelet; I. upper glume of the sessile spikelet; J. pedicelled spikelet with rachis joint.

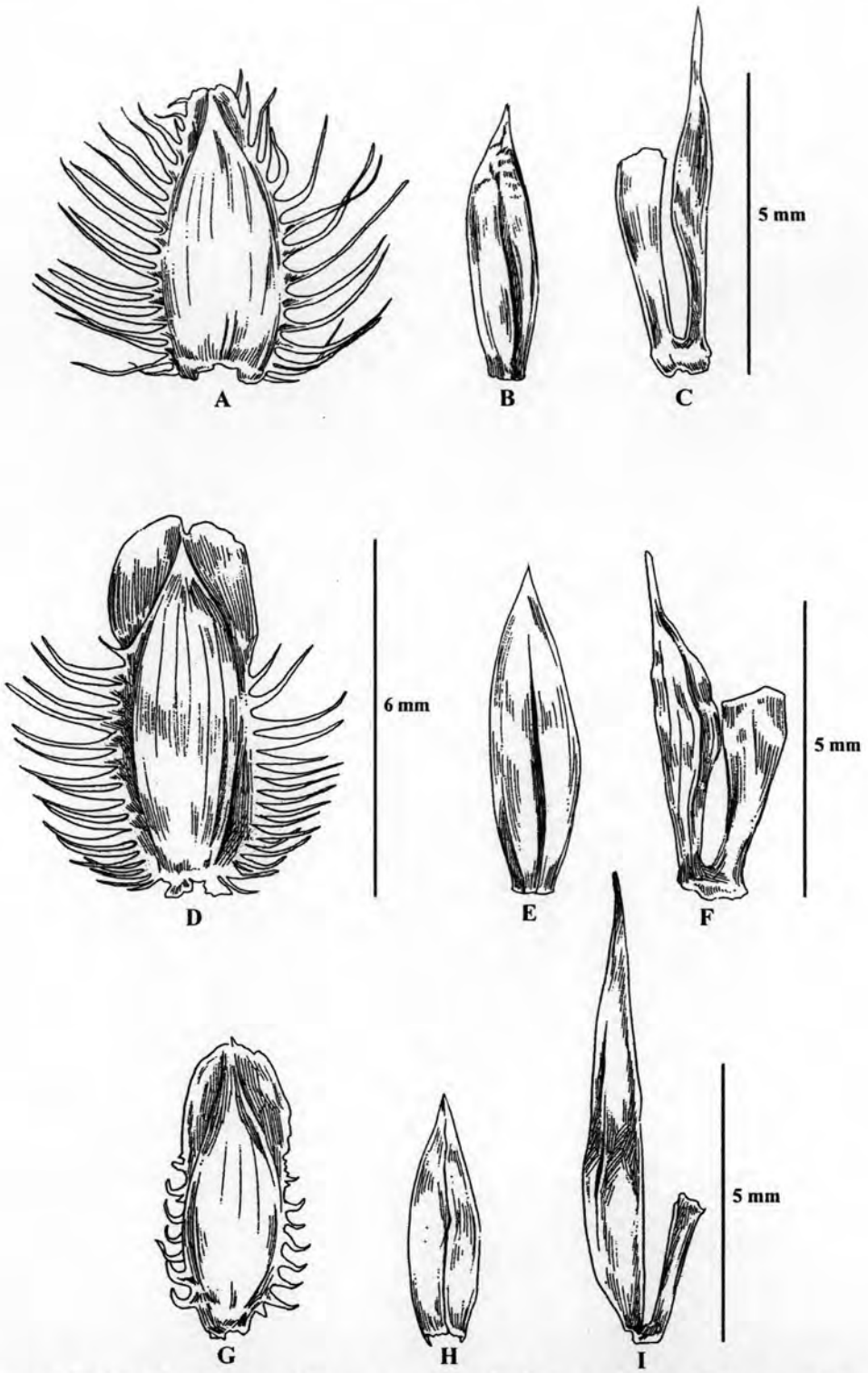

Figure 5.10 A-C. *Eremochloa maxwellii*: A. lower glume of the sessile spikelet; B. upper glume of the sessile spikelet; C. pedicelled spikelet with rachis joint. D-F. *E. muricata*: D. lower glume of the sessile spikelet; E. upper glume of the sessile spikelet; F. pedicelled spikelet with rachis joint. G-I. *E. petelotii*: G. lower glume of the sessile spikelet; H. upper glume of the sessile spikelet; I. pedicelled spikelet with rachis joint.

Figure 5.11 *Eremochloa* sp.1: A. plant; B. lower glume of the sessile spikelet; C. upper glume of the sessile spikelet; D. pedicelled spikelet with rachis joint. All line drawings were drawn by P. Traiperm from *P. Traiperm* 125.

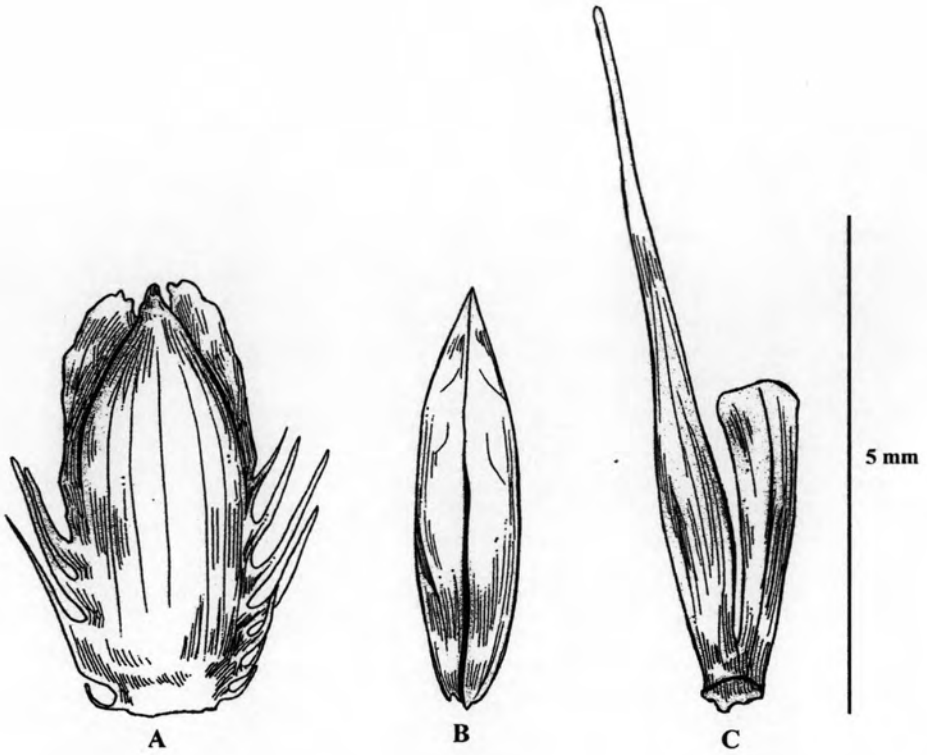

Figure 5.12 *Eremochloa* sp.2: A. lower glume of the sessile spikelet; B. upper glume of the sessile spikelet; C. pedicelled spikelet with rachis joint.

2. HACKELOCHLOA

Kuntze., Rev. Gen. Pl. 2: 776. 1891.— Type species: *H. granularis* (L.) Kuntze.

Rytilix Hitchc., in U.S. Dept. Agric. Bull. 772: 278. 1920. *nom. superfl. pro. Hackelochloa.*

Annual, tufted or solitary. *Culms* erect. *Leaf-sheath* loose. *Ligules* membranous, ciliate. *Leaf-blade* linear or broadly linear. *Inflorescence* composed of several racemes on terminal or axillary, each raceme subtended by spatheole. *Sessile spikelets* united with rachis; dorsally compressed. *Glumes*; lower glume swoolen and hemispherical, pitted or reticulate on the back; upper glume adhering to the cavity. *Lower floret*; lemma, hyaline; palea absent. *Upper floret*; fertile. *Pedicelled spikelet* neuter. *Pedicels* fused to rachis internode.

A genus of 2 species throughout the tropics. Distributed in weedy places; both species occur in Thailand.

KEY TO THE SPECIES

1. Sessile spikelets subglobose, *ca.* 1.5 mm long. Lower glume of the sessile spikelets pitted and tubercle on the back**1.** **H. granularis**
1. Sessile spikelets broadly oblong, *ca.* 2.5 mm long. Lower glume of the sessile spikelets ridged and reticulate on the back **2. H. porifera**

1. Hackelochloa granularis (L.) O. Kuntze., Rev. Gen. Pl. 2: 776. 1891.

Cenchrus granularis L., Mant. 2, App. 575. 1771.— Type: India orientalis, *Herb. Linn.* 1217-12 (LINN!).

Annuals grass, tufted or solitary. *Culms* erect, 15–80 cm tall, subterete on the lower part, grooved on the upper part, glabrous. *Leaf-sheath* loose, flat, pilose with tubercle-based hairs, 1–4 cm long. *Ligules ca.* 1 mm long, membranous with cilia. *Leaf-blade* linear, 2–13 by 1–1.5 cm, pilose with tubercle-based hairs on both surfaces especially on the margins, base round or subcordate, apex acute. *Inflorescence* composed of several racemes on terminal and axillary, with 1–5 racemes, each raceme subtended by spatheole, raceme 5–15 mm long; peduncle 10–30 mm long; rachis

oblong, flattened, 12–15 mm long, fragile at the nodes; adherent to upper glume of sessile spikelets, rachis internode tip transverse, cup-shaped; spikelets dorsally compressed, in pairs, sessile and the other one pedicelled. *Sessile spikelets* subglobose, united with rachis. *Glumes*; lower glume turgidly swollen and hemispherical, coriaceous, *ca.* 1.5 mm diam., pitted and tubercled on the back; upper glume broadly ovate-obtuse, *ca.* 1 mm long, hyaline, enfolded, adhering to the cavity. *Lower floret*; lemma ovate, *ca.* 0.8 mm long, hyaline; palea absent. *Upper floret*; lemma ovate-obtuse, *ca.* 0.8 mm long, hyaline; palea ovate, *ca.* 0.6 mm long, hyaline. *Anthers* 3, *ca.* 0.2 mm. *Pedicelled spikelet* neuter. *Pedicels* completely fused with rachis; united whoolly; oblong. *Glumes*; lower glume elliptic, *ca.* 10 mm long, 4–5-nerved, keeled, scabrous on keel; upper glume elliptic, 6–8 mm long, 5–6-nerved, enfolded, keeled and scabrous on back. *Caryopsis* orbicular, dorsally compressed (Figs. 5.13 & 5.39A. & B).

Thailand.— NORTHERN: Mae Hong Son [Doi Pui, 23 Sept. 1995, *K. Larsen et al.* 46828 (AAU, L)], Chiang Mai [Doi Suthep, 4 Dec. 1911, *A.F.G. Kerr* 2213 (E, K); 23 Jul. 1958, *Th. Sørensen et al.* 4378 (BKF, C, K); 14 Sept. 1958, 4988 (C); 17 Sept. 1958, 5038 (C, E, K); 8 Sept. 1967, *K. Iwatsuki et al.* T-9458 (AAU, BKF, C, E, K, L); 18 Sept. 1967, *T. Shimizu et al.* T-10464 (BKF); en route from Sop Aep to Pha Mawn (Ban Yang), 1 Oct. 1971, *G. Murata et al.* T-15609 (AAU, BKF, C, K, L, P); Mueang, near the summit of Doi Come at Doi Come Temple, S tip of Doi Suthep, Mae Heeyah, 10 Sept. 1988, *J.F. Maxwell* 88-1066 (AAU, BKF, CMU, L); Ang Kang, 9 Jan. 1974, *Umpai* 517 (BKF); Doi Inthanon, Siriphum water falls, 23 Jul. 1988, *H. Koyama* T-61037 (BKF, L); 23 Jul. 1988, *M.N. Tamura* T-60223 (BKF); 23 Jul. 1988, *S. Tsugaru* T-61739 (BKF, L): S side of Mae Klang river, 8 Jan. 1988, T-61246 (BKF); 15 Sept. 1995, *BGO. Staff* 4306 (QBG); Wang Kwai waterfalls, 13 Aug. 1996, *BGO. Staff* 7113 (QBG); Hot, Op Luang National Park, Doi Op Luang, Mae Jam river, 15 km W of Hot, 23 Oct. 1987, *J.F. Maxwell* 87-1277 (BKF, CMU, L); 23 Nov. 2005, *P. Traiperm* 299 (BCU, BKF, KKU), 303 (BCU, BKF, KKU); Chiang Dao District, 2 Nov. 1999, *M. Norsangsri* 894 (QBG); Doi Chiang Dao Wildlife Sanctuary, SE side, along the road to Ban Yang Toong Bong Forest Station, 22 Sept. 1990, *J.F. Maxwell* 90-1032 (AAU, CMU, L); 24 Nov. 1989, *Y. Paisooksantivathana* y 2569-89 (BK); Doi Dao (Tau) Ban San Ba Dam, 16 Aug. 1992, *J.F. Maxwell* 92-432 (L); Sangamphaeng, Doi Mueang Awn, W side area,

Sahagawn, Mae Awn Branch, 15 Sept. 1998, *P. Palee* 400 (L); NW of Mae Taeng, 9 Mar. 1958, *Th. Sørensen et al.* 4711 (C); Mae Taeng, Pah Dang (Red Lahu) Village, Geut Chang, 22 Jul. 2000, *J.F. Maxwell* 00-316 (L); 9 Aug. 1996, 96-1056 (BKF, L); 28 Aug. 1997, 97-904 (BKF, L); Mae Rim, 11 Aug. 1994, *M. Norsaengsri* s.n. (QBG); 16 Sept. 1995, *W. Nanakorn et al.* 4451 (QBG); 25 Sept. 1995, *M. Norsaengsri* s.n. (QBG); 24 Jul. 1996, *BGO. Staff* 6935 (QBG); 3 Sept. 1996, *BGO. Staff* 7379 (QBG), s.n. (QBG); Mae Rim, Mae Sa Mai (Hmong) Village, Mae Ram subdistrict, 20 Nov. 1998, *R. Wehner* 41 (L); E of nursery, Queen Sirikit Botanical Garden, 7 Oct. 2001, *S. Laegaard* 21684 (AAU, L); 11 Oct. 2001, 21690 (AAU); 26 Nov. 2005, *P. Traiperm* 310 (BCU, BKF, KKU); Proaw, Paa Mae Bon, 12 Jul. 1996, *BGO. Staff* 7 (QBG)], Chiang Rai [Mueang Payao, 13 Jul. 1931, *Put* 3989 (BK, BM, K); Doi Tung, 25 Sept. 1967, *K. Iwatsuki et al.* T-11135 (AAU, BKF, C, E, L)], Lamphun [Mae Tah, Doi Khun Tan National Park, base of the W side, at Ba Teung Station, 28 Jul. 1994, *P. Palee* 237 (BKF, L)], Lampang [Chae Son National Park, 3 Nov. 1966, *J.F. Maxwell* 96-1478 (L); Campus of Huai Tak Forest Station, 22 Sept. 1967, *T. Shimizu* T-10596 (BKF, L); Wahng Nua, Doi Luang National Park, Wahng Gayo Falls area, 6 Sept. 1997, *J.F. Maxwell* 97-952 (BKF, L)]; NORTH-EASTERN: Loei [Phu Kradueng, Samhaek, 1 Oct. 1954, *T. Smitinand* 1989 (BKF, K); 28 Aug. 1988, *H. Koyama* T-61379 (AAU, BKF, L); Wang Saphung, Sithan, 17 Oct. 1955, *T. Smitinand* 3056 (BKF); Phu Luang, 31 Aug. 1996, *S. Phusomsaeng & K. Bunchai* 23 (BKF, K, L); 14 Oct. 2000, *M. Norsangsri* 1083 (QBG); Na Haeo, 5 Nov. 1995, *NH* 5-46 (QBG)], Nong Khai [Si Chiang Mai, 18 Aug. 1972, *T. Smitinand* 11645 (BKF, L)], Sakon Nakhon [Nam Phung Dam, 17 Oct. 1990, *P. Chantaranothai & J. Parnall* 90/779 (AAU, K)]; SOUTH-EASTERN: Chon Buri [Khao Khiao, Si Racha, 4 Sept. 1975, *J.F. Maxwell* 75-983 (AAU, BK, L)].

Distribution.— Worldwide.

Ecology.— In dry dipterocarp forests, scattered on grassy slope in forest, up to 1,450 m altitude. Flowering in July to March.

Vernacular.— Ya kha naeng (หญ้าแขนง) (Chiang Rai).

Notes.— This species resembles *Hackelochloa porifera* in having lower glume turgidly swollen and hemispherical. It differs from the latter in having a small lower glume, 1.5 mm diam., pitted and tubercled on the back, raceme 5–15 mm long

while lower glume *ca.* 2.5 mm long, ridged and reticulate on the back and raceme 2.5–4.5 cm long in *H. porifera*.

Used.— *H. granularis* is prescribed internally with a little sweet oil, in cases of enlarged spleen and liver (Bor, 1960).

2. Hackelochloa porifera (Hack.) D. Rhind, Grasses of Burma: 77. 1945.

Manisuris porifera Hack., Oest. Bot. Zeit. 41: 48. 1891.— Type: Sikkim, Darjeeling, *C.B. Clarke* 9752 A (holotype W, isotype K!).

Annuals grass, tufted or solitary. *Culms* erect, 50–200 cm tall, subterete, glabrous. *Leaf-sheath* loose, flat, hirsute with tubercle-based hairs, 2–6 cm long. *Ligules* membranous, 2.5–3.5 mm long, ciliate. *Leaf-blade* broadly linear, 5–30 by 1–2.5 cm, hirsute with tubercle- based hairs on both surfaces, margins scabrous, base round, apex acute. *Inflorescence* composed of several raceme on terminal and axillary, with 2–4 racemes, each raceme subtended by spatheole, raceme 2.5–4.5 cm long; peduncle 3–8 cm long; rachis oblong, flattened, 20–22 mm long, fragile at the nodes; adherent to upper glume of sessile spikelets, rachis internode tip transverse, cup-shaped; spikelets dorsally compressed, in pairs, sessile and the other one pedicelled. *Sessile spikelets* broadly oblong, united with rachis. *Glumes*; lower glume turgidly swollen, hemispherical, *ca.* 2.5 mm long, coriaceous and robust, ridged and reticulate on the back; upper glume broadly ovate, boat-shaped, 1.5–1.8 mm long, membranous, adhering to the cavity. *Lower floret* barren; lemma broadly ovate-obtuse, *ca.* 1 mm long, hyaline; palea absent. *Upper florets* fertile; lemma broadly ovate-obtuse, *ca.* 1 mm long, hyaline; palea ovate, *ca.* 0.8 mm long, hyaline. *Pedicelled spikelet* neuter. *Pedicels* completely fused with rachis; united whoolly; oblong, 18–20 mm long. *Glumes*; lower glume narrowly ovate, 3–3.5 mm long, 5–6-nerved, enfolded, scabrous on the margins; upper glume elliptic, 2.8–3 mm long, 5-nerved enfolded, keeled and scabrous on back. *Caryopsis* orbicular, dorsally compressed, 1–1.2 mm in diam. (Figs. 5.14 & 5.39C-E).

Thailand.— NORTHERN: Chiang Mai [E of nursery of Queen Sirikit Botanical Garden, 16 Sept. 1995, *M. Norsaengsri* 742 (QBG); 17 Sept. 1995, *W. Nanakorn et al.* 4453 (QBG); 25 Sept. 1995, *M. Norsaengsri* 737 (QBG); 7 Oct.

2001, *S. Laegaard* 21684 (AAU); 11 Oct. 2001, *S. Laegaard* 21689 (AAU); 26 Nov. 2005, *P. Traiperm* 311 (BCU, BKF, KKU)].

Distribution.—India, Indo-China.

Ecology.— In bamboo forest or weedy in open ground, at sea level to 1,500 m altitude. Flowering in September to November.

Notes.—*Hackelochloa porifera* has been treated as a synonym of *H. granularis* by Veldkamp *et al.* in 1986, but I still to retain *H. porifera* as a species because of the difference of the lower glume of the sessile spikelet of the two species.

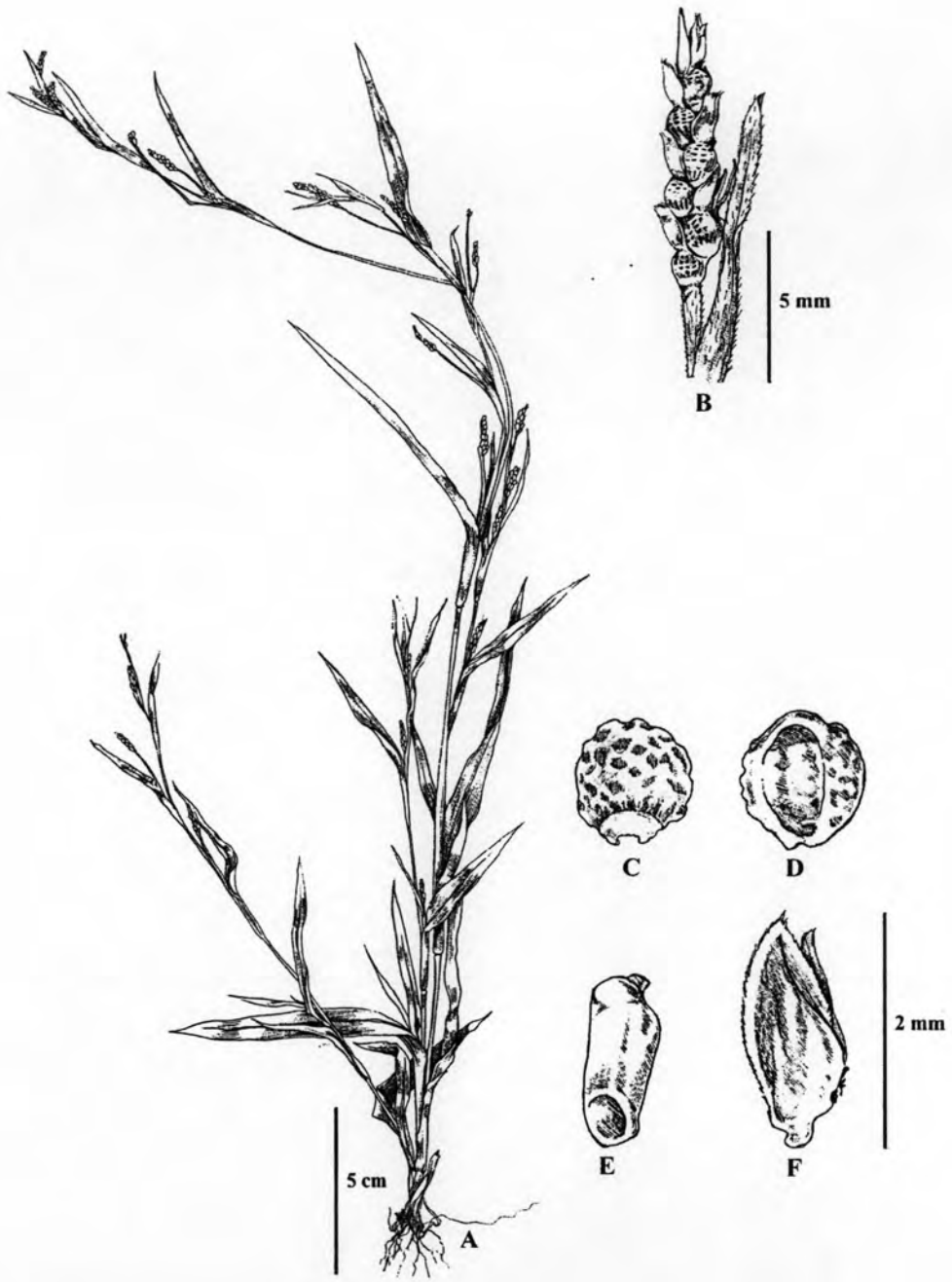

Figure 5.13 *Hackelochloa granularis*: A. plant; B. raceme; C. & D. two views of the lower glume of the sessile spikelet; E. rachis joint; F. pedicelled spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 299.

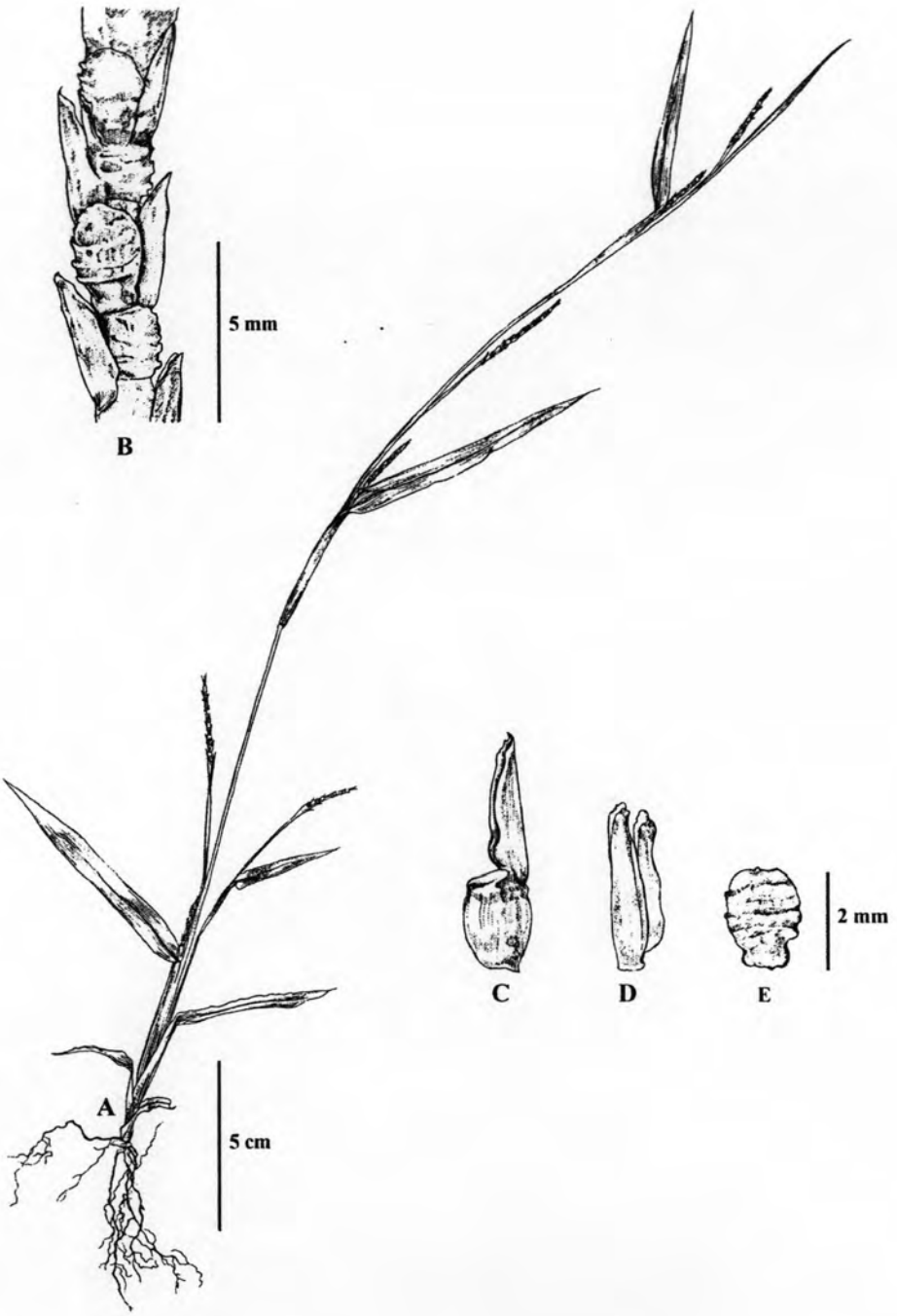

Figure 5.14 *Hackelochola porifera*: A. plant; B. partial raceme; C. rachis joint with sessile and pedicelled spikelet; D. pedicelled spikelet; E. lower glume of the sessile spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 311.

3. HEMARTHRIA

R. Br., Prodr. Fl. Nov. Holl.: 207. 1810. — Type species: *H. compressa* (L. f.) R. Br.

Lodicularia P. Beauv., Ess. Agrost.: 108. 1812.— Type species: *L. fasciculata* (Lam.) P. Beauv., *nom. superfl.* [= *H. altissima* (Poir.) Stapf & C.E. Hubb.].

Coelorachis Brongn. Subg. Neobalansaea A. Camus, Ann. Soc. Linn., Lyon 68: 198. 1921.— Type species: *C. pratensis* (Balansa) A. Camus [= *H. pratensis* (Balansa) Clayton].

Perennial, mostly rambling. *Inflorescence* axillary, a single flattened dorsiventral raceme with tough rachis; internodes clavate, usually obliquely articulated. *Sessile spikelet*; lower glume rigidly herbaceous, smooth, indistinctly winged above, obtuse to caudate; upper glume sometimes awned; lower florets barren, without palea. *Pedicelled spikelet* resembling sessile, but base truncate, lacking callus; *pedicel* fused to internode.

A genus of 14 taxa in the Old World tropics and subtropics, especially in SE Asia, 1 introduced in the New World. Typically found in wet places habitats; 6 species occur in Thailand.

KEY TO THE SPECIES

1. Sessile spikelets about twice as long as the joints — **4. H. longiflora**
1. Sessile spikelets less than twice as long as the joints
  2. Culms erect to decumbent
    3. Lower glume caudate — **3. H. debilis**
    3. Lower glume obtuse to acuminate
      4. Culms rooting at the lower nodes
        5. Margins of the lower glume scabrous — **1. H. altssima**
        5. Margins of the lower glume smooth — **2. H. compressa**
      4. Culms tufted, not rooting at the lower nodes — **5. H. pratensis**
  2. Culms creeping — **6. H. stolonifera**

1. Hemarthria altissima (Poir.) Stapf & C.E. Hubbard, Bull. Misc. Inform. Kew 1934: 109. 1934.

Rottboellia altissima Poir., Voy. Barb. 2: 105. 1789.— Type: *Poiret* s.n. (holotype P!, phototype US).

H. fasciculata (Lam.) Kunth var. *gracilis* Balansa, Bull. Soc. Bot. France 21: 11. 1874.— Type: *Balansa* 1866 (holotype P!).

R. heterochroa Gand., Bull. Soc. France 66: 302. 1920.— Type: *Schlechter 6906* (holotype LY, isotype K!).

H. guyanensis Steud., Syn. Pl. Glumac. 1: 359. 1854.— Type: *Leprieur* s.n. (holotype L!, isotype P!)

Perennial grass, rhizomatous. *Culms* erect to decumbent up to 80 cm tall, rooting at lower nodes, compressed, nodes and internodes glabrous. *Leaf-sheaths* loose, glabrous except upper margins pilose. *Ligules* ciliolate, 0.5–1 mm long. *Leaf-blade* linear-acuminate, 5–20 by 0.2–0.7 mm, folded, scabrous along the margins towards the tips and mid-nerved, glabrous, base round, pilose near mouth, slightly folded. *Inflorescence* racemes, compressed, 4–10 cm long, one to several per node on terminal and axillary, rachis internodes and nodes glabrous, callus triangular, *ca.* 1 mm long, glabrous. Spikelets oblong; pedicel of the pedicelled spikelet and the internode the rachis fused and together hollowed to accommodate the sessile spikelet. *Sessile spikelet* flat. *Glumes*; lower glume oblong, 4.5–6 by *ca.* 1 mm, 4-5 scarcely nerved, coriaceous, pale green or dark purple, scabrous along margins and on the lower nerve, glabrous on the back, bifid, with 2 apical wings; upper glume boat-shaped, 4.5–5 mm long, membranous, adhering to the hollow of the rachis, acute. *Lower floret* barren; lemma oblong-obtuse *ca.* 4 mm long, hyaline, slightly folded; palea absent. *Upper floret* fertile; lemma lanceolate-acute, 3.5–4 mm long, hyaline, folded; palea oblong-obtuse, *ca.* 1.5 mm long, hyaline, slightly folded. *Anthers* 3, *ca.* 2 mm long. *Pedicelled spikelet*; pedicels oblong, compressed, 4.5–5 mm long, slender, scabrous along keeled. *Glumes*; lower glume oblong-obtuse, 5–5.5 by *ca.* 0.1 mm, coriaceous, folded, scabrous along margins, apex slightly winged; upper glume boat-shaped, acuminate, 5–5.5 by *ca.* 0.8 mm, coriaceous, keeled and scaberulous on the back. *Lower floret*; lemma oblong-muticous, *ca.* 4 mm long, hyaline, slightly

folded; palea absent. *Upper floret*; lemma lanceolate-acute or boat-shaped, *ca.* 3.5 mm long, hyaline; palea oblong, *ca.* 2 mm long, hyaline (Figs. 5.15A-D & 5.40A-D).

Thailand.— NORTH-EASTERN: Loei [Phu Kradueng, near camp, 11 Mar. 1952, *T. Smitinand* 1146 (K)].

Distribution.— Worldwide.

Ecology.— Common among the other grasses in open pine forest at 1,300 m altitude. Flowering in March.

Notes.— *Hemarthria altissima* is easily confused with *H. compressa* by shape and size of the lower glume, but it differs from the latter in having margins of the lower glume scabrous while margins smooth in *H. compressa.*

2. Hemarthria compressa (L. f.) R. Br., Prodr. 207. 1810.

Rottboellia compressa L. f., Suppl.: 114. 1781. — Type: 'in Indiis' (not extant). neotype *Wallich* 8871-E (holotype L!, isotypes K!, P!,).

H. laxa Nees ex Steud., Syn. Pl. Glumac. 1: 358. 1854.— Type: *Wall. Cat. no.* 8871 (holotype P!, isotypes K!, L, NY).

Perennial grass, rhizomatous. *Culms* erect to decumbent up to 1 m tall, rooting at the lower nodes, compressed, nodes and internodes glabrous. *Leaf-sheaths* loose, 2–4.5 cm long compressed and keeled, glabrous except the upper margins pilose, 2–4.5 cm long. *Ligules* a ciliolate, 0.3–1 mm long. *Leaf-blades* linear-acuminate, up to 10 by *ca.* 0.2 cm folded, scaberulous along the margins towards the tips and midnerve, glabrous, base round, slightly enfolded. *Inflorescence* racemes, compressed, 7–12 cm long, rachis internodes and nodes glabrous, callus triangular. Spikelets oblong; pedicel of the pedicelled spikelet and the internode of the rachis fused and together hollowed to accommodate the sessile spikelet. *Sessile spikelet* flat. *Glumes*; lower glume oblong, 4.5–6 by ca 1.5 mm, 6–7 scarcely nerved, coriaceous, pale green or dark purple, margins smooth and folded, glabrous on the back, bifid, with 2 apical wings; upper glume boat-shaped, 4.5–6 mm long, membranous, adhering to the hollow of the rachis, apex acute. *Lower floret* barren; lemma enfolded, 3–4 mm long, hyaline, muticous. *Upper floret* fertile; lemma oblong, 3.5–4 by 1 mm, hyaline, slightly enfolded, acute sometime muticous; palea oblong, *ca.* 1.5 mm long, hyaline, muticous. *Anthers* 3, *ca.* 2 mm long. *Lodicules* cuneate, *ca.* 0.5 mm long.

Ovary cylindrical, *ca.* 0.8 mm long. *Pedicelled spikelet*; pedicels compressed, 4.5–7 mm long, glabrous, slender. *Glumes*; lower glume oblong, 5–6 mm long, 7–8 scarcely nerved, coriaceous, pale green or dark purple, slightly enfolded, margins scabrous, glabrous on the back, tapering to the apex; upper glume boat-shaped, acuminate, 6–7 mm long, coriaceous, keeled and scaberulous on the back. Lower floret; lemma oblong-muticous, *ca.* 3.2 mm long, hyaline, enfolded, palea absent. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers ca.* 2 mm long. *Ovary* cylindrical, *ca.* 0.5 mm long (Figs. 5.15E-H & 5.40E-J).

Thailand.— NORTHERN: Mae Hong Son [Khun Yuam, 7 Sept. 1974, *K. Larsen & S.S. Larsen* 34242 (AAU, BKF, K, L)], Chiang Mai [Doi Suthep, 20 Jul. 1911, *A.F.G. Kerr* 1934 (BM, E, K, TCD); Fang, 24 May 1959, *Th. Sørensen et al.* 3576 (C, E, K); Mae Rim, 15 km N of Chiang Mai, 15 Jul. 1968, *K. Larsen et al.* 2480 (AAU, BKF, E); near Chiang Mai waterlogged plain along highway, 26 Sept. 2001, *S. Laegaard & M. Norsaengsri* 21619 (AAU, K)], Chiang Rai [12 km SE of Fang along the Fang-Chiang Rai trail, 26 Jul. 1968, *K. Larsen et al.* 2743 (AAU, BKF, E, K, L)], Phrae [Long, Tao Poon, Mae Ram village, 27 Nov. 1986, *Y. Paisooksantivathana* y 1935-86 (BK)], Sukhothai [Between Sukhothai and Sawankhalok, 28 Jun. 1973, *G. Murata et al.* T-17026 (BKF)]; NORTH-EASTERN: Loei [Phu Kradueng, near camp, 11 Mar. 1952, *T. Smitinand* 6381 (K)]; EASTERN: Chaiyaphum [Phu Khiao, 27 Nov. 2004, *P. Traiperm* 187 (BCU, BKF, KKU)], Nakhon Ratchasima [Phimai, 15 Oct. 2005, *P. Traiperm* 215 (BCU, BKF, KKU)]; CENTRAL: Phra Nakhon Si Ayutthaya [Ban Hin Kong near Wang Noi, about 80 km N of Krung Thep Maha Nakhon , 8 Mar. 1971, *G. Murata et al.* T-14739 (BKF)], Krung Thep Maha Nakhon [12 Sept. 1920, *A.F.G. Kerr* 4468 (BM, K); 1 Jul. 1923, *A. Marcan* 1403 (BM); 16 Nov. 1923, *A.F.G. Kerr* 7944 (BK, BM, K); 30 Aug. 1928, *A.F.G. Kerr* 19717 (BK, BM); 10 Sept. 1919, *A.F.G. Kerr* 3764 (BM, K)]; SOUTH-EASTERN: Chanthaburi [Between Chanthaburi and Pong Nam Ron, 8 May 1973, *G. Murata et al.* T-17726 (BKF)].

Distribution.— India, China, Indo-China, Malesia.

Ecology.— Growing in paddy field near swampy place, moist places along roads, water courses, at sea level to 1,300 m altitude. Flowering in March to November.

3. Hemarthria debilis Bor, Dansk Bot. Ark. 23 (2): 162. 1965.— Type: Thailand, Chanthaburi: Makham, *K. Larsen* 10117 (holotype C!, isotypes BKF!, E!, L!).

Annuals grass, caepitose, slender. *Culms* erect, 20–60 cm tall, terete, internodes glabrous, nodes pubescent. *Leaf-sheaths* loose. *Ligules* membranous with ciliate hairs, *ca.* 1 mm long. *Leaf-blades* linear, enfolded, 1–3.5 by 0.1–0.4 cm, glabrous, apex acuminate. *Inflorescence* composed of several racemes, compressed on terminal or axillary, 10–15 cm long, rachis internodes oblong, flat, 7–10 mm long, glabrous, nodes glabrous. Spikelets dorsally compressed. *Sessile spikelet* shorter than the rachis internodes, 9–10 mm long. *Glumes*; lower glume oblong to elliptic, 8.5–10 mm long, 5–7-nerved, coriaceous, flattened, caudate, bifid, scabrous along tail; upper glume lanceolate or boat-shaped, 7–8.5 mm long, 3-nerved, thinner than lower glume, glabrous on the back, apex with long caudate, scabrous along tail. *Lower floret* sterile; lemma oblong-obtuse, 3–5 by *ca.* 0.5 mm, hyaline, slightly folded; palea absent. *Upper floret* fertile; lemma oblong-obtuse, 2.5–4.5 by *ca.* 0.5 mm, hyaline; palea absent. *Lodicules* cuneate, 0.5 mm long. *Pedicelled spikelet* 8–8.5 mm long. *Pedicels* oblong, slender, 5–6 mm long, glabrous, the pedicel and the internode of the rachis fused and together hollowed to accommodate the sessile spikelet but sometimes separated from the hollow internodes. *Glumes*; lower glume oblong-elliptic, 8–8.5 mm long, 7-nerved, flattened, caudate, bifid, scabrous along tail; upper glume boat-shaped, 8-8.5 mm long, 3–5-nerved, caudate, scabrous. *Upper floret*; lemma *ca.* 2.5 by 0.4 mm, hyaline. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers ca.* 1 mm long. *Ovary* cylindrical. *Caryopsis* ellipsoid, *ca.* 1.5 mm long (Figs. 5.16A-E & 5.41A-E).

Thailand.— SOUTH-EASTERN: Chanthaburi [5 km N of Makham, 15 Jun. 1963, *K. Larsen* 10117 (BKF, C, E, L)].

Distribution.— Endemic to Thailand.

Ecology.— Growing in swampy area, at 50 m altitude. Flowering in July.

Notes.— Known only from the type specimen.

4. Hemarthria longiflora (Hook.f.) A. Camus in Fl. Gén. Indo-Chine 7: 380. 1922.

Rottboellia longiflora Hook.f., Fl. Brit. India. 7: 154. 1896.— Type: *Griffith KD* 1009 (holotype K!).

R. tonkinensis A. Camus in Bull. Mus. Hist. Nat. (Paris). 25: 369. 1919.— Type: Vietnam, Tonkin, *Balansa* 1783 (holotype P!, isotypes K!, L!).

H. longiflora (Hook.f.) A. Camus var. *tonkinensis* A. Camus in Fl. Gén. Indo-Chine 7: 379. 1922.

Perennial grass, tufted. *Culms* erect, 0.7–1 m tall, compressed, internodes glabrous, nodes grayish ciliate, 1–1.5 mm long. *Leaf-sheaths* loose, folded, 5–6.5 cm long, glabrous but pilose and scabrous along the margins. *Ligules* densely whitish-grey ciliate, 1–1.2 mm long. *Leaf-blades* linear, 13–20 by 5–6 mm, margins scabrous, apex acute. *Inflorescence* racemes, one to several per node, dorsally compressed on axillary or terminal. Spikelets dorsoventrally compressed. *Sessile spikelet* about twice as long as the rachis internodes. *Glumes*; lower glume lanceolate, 15–17 by 1.5–1.8 mm, 6–8-nerved, coriaceous, strigillose on the back, scabrous along the margins towards the tips, acuminate and caudate, bifid; upper glume boat-shaped, 10–12 by 1.5–1.8 mm, 1-nerved, coriaceous, thinner than the lower glume adhering to the hollow of the rachis but sometimes separated from the hollow, acuminate and caudate. *Lower floret* barren; lemma oblong-obtuse, *ca.* 5 mm long, hyaline, slightly folded; upper floret fertile; lemma oblong-ovate, 4–4.5 by *ca.* 1 mm, hyaline, enfoldeds, apex acute; palea ovate, 3.8–4 by *ca.* 1 mm, hyaline, enfolded, apex acute. *Anthers* 3, 0.5–1 mm long. *Ovary* elliptic, *ca.* 1.5 by 0.5 mm. *Pedicelled spikelet*; pedicels flattened, 5–8 mm. *Glumes*; lower glume linear to lanceolate, 11-13 by *ca.* 1 mm, 5–7-nerved, subcoriaceous, scabrous along the margins towards the tips, apex acuminate and caudate; upper glume boat-shaped, 13–18 by *ca.* 1 mm, subcoriaceous, apex acuminate and caudate, scabrous keeled on the back. *Lower florets* barren; lemma oblong-obtuse, 1–1.5 mm long. *Upper floret* fertile; lemma *ca.* 3.2 mm long, hyaline, enfolded; palea *ca.* 2.8 mm long, hyaline, enfolded (Figs. 5.16F-M & 5.41F-J).

Thailand.— NORTHERN: Chiang Mai [near Wangka, 13 May 1946, *Wichian* 491 (BKF, K, P); 6 Oct. 1960, *T. Smitinand & H.St. John* 6824 (BKF, K); near Fang, 25 May 1958, *Th. Sørensen et al.* 3594 (BKF, C); below the summit of Doi Pha Hom Pok, 13 Sept. 1967, *K. Iwatsuki et al.* T-9622 (BKF)], Chiang Rai [Mae Tun, 5 Jul. 1922, *A.F.G. Kerr* 6253 (BK, BM)]; NORTH-EASTERN: Udon Thani [Ban Paeo, 23 Apr. 2006, *P. Traiperm* 383 (BCU, BKF, KKU)], Nakhon Phanom

[Paknam Songkram, 7 May 1932, *A.F.G. Kerr* 21357 (BKF, BM, K)], Khon Kaen [Khon Kaen on the way to Chumphae, 6 Jul. 1959, *T. Smitinand* 5839 (BKF, K)]; EASTERN: Nakhon Ratchasima [N of Korat, 5 Jul. 1959, *F.Floto* 7313 (BKF, C, K); Chakkarat, *M. Norsaengsri* 2403 (KKU)]; SOUTH-WESTERN: Kanchanaburi [Si Sawat, 27 May 1962, *Kasem* 186 (BK)]; CENTRAL: Chai Nat [Chao Phya Dam, 3 Jun. 1959, *T. Smitinand* 5822 (BKF, K)], Saraburi [Pasak river, 25 May 1923, *A.F.G. Kerr* 7014 (BK, BM, K)], Krung Thep Maha Nakhon [5 Jul. 1920, *A.F.G. Kerr* 4363 (BM, TCD]; SOUTH-EASTERN: Chanthaburi [Plain of Makham, 14 Jun. 1963, *Thai-Danish* 10092 (BKF, C)].

Distribution.— China, Indo-China, Malesia.

Ecology.— Erect grass, common by path in wet place, at 5-2,350 m altitude. Flowering in April to October.

Notes.— Extremely variable in size of the lower glume of sessile spikelet. In the present species the two glumes of both spikelets are long awned, and the sessile spikelets are twice as long as the joint.

5. Hemarthria pratensis (Balansa) Clayton in Kew Bull. 24: 314. 1970.

Rottboellia pratensis Balansa, J. Bot. (Morot) 4: 110. 1890.— Type: Vietnam, Couaïnak, *Balansa* 1786 (holotype L!, isotype K!).

Coelorachis pratensis (Balansa) A. Camus, Ann. Soc. Linn., Lyon 68: 198. 1921.

H. subulata Reeder in J. Arnold. Arbor. 29: 350. 1948.— Type: New Guinea, Middle Fly River, *Brass* 7552 (holotype US, isotypes A, L!).

Perennial grass, tufted, caepitose, not rooting from the lower nodes. *Culms* erect, 50–100 cm tall, terete, nodes and internodes glabrous. *Leaf-sheaths* loose, 6–15 cm long, glabrous, pilose at the margins. *Ligules* ciliate, 5–10 mm long. *Leaf-blades* narrowly linear, enfolded, up to 50 by 2–3 mm, pilose on adaxial surface, abaxial surface glabrous, margins scabrous, apex acute, sometime muticous. *Inflorescence* racemes, compressed on terminal or axillary up to 20 cm long, rachis internodes oblong, 11–12 mm long, glabrous, nodes glabrous, callus *ca.* 3 mm long, glabrous. Spikelets oblong; the pedicel of the pedicelled spikelet and the internode of the rachis fused and together hollowed to accommodate the sessile spikelet. *Sessile spikelet* compressed. *Glumes*; lower glume linear-oblong, 7.5–8 by 1.2–1.5 mm, 6–7-nerved,

coriaceous, pale green, scaberulous along the margins towards the end, apex bifid with 2-apical wings; upper glume boat-shaped, 6.5–8 mm long, membranous, adhering to the hollow of the rachis, acute to acuminate. *Lower floret* barren; lemma oblong, 5–5.5 by *ca.* 1 mm, hyaline, slightly folded, muticous. *Upper floret* fertile; lemma oblong-muticous, *ca.* 5.5 by 1 mm, hyline; palea oblong, 2–2.5 by *ca.* 0.5 mm, hyaline, muticous. *Lodicules* 2, cuneate, *ca.* 0.8 mm long. *Ovary* cylindrical, *ca.* 1 mm long. *Anthers ca.* 4.5 mm long. *Pedicelled spikelet*; pedicels terete, slender, glabrous up to 20 mm long. *Glumes*; lower glume long triangular, 9–9.5 by 1 mm, 5-nerved, coriaceous, pale green, slightly enfolded, margins scabrous, acute or muticous, tapering to the apex; upper glume boat-shaped, 9–10 mm long, coriaceous, pale green, keeled and scabrous on the back, folded, tapering to the end. *Lower floret* barren; lemma oblong, 5–5.5 by *ca.* 1 mm, hyaline, acute or muticous at the apex. *Upper floret* fertile; lemma oblong-acute, 4.5–5 by *ca.* 1 mm, hyaline, enfolded, palea linear, *ca.* 2 by 0.3 mm, hyaline, muticous. *Lodicules* 2, cuneate, *ca.* 0.8 mm long. *Anthers* 4–4.5 mm long. *Ovary* cylindrical (Figs. 5.17 & 5.42A-F).

Thailand.— NORTH-EASTERN: Loei [Phu Kradueng trail, 13 Mar. 1924, *A.F.G. Kerr* 8718 (BKF, K); Phu Kradueng, 18 Mar. 1958, *Th. Sørensen et al.* 2240 (BKF, C, E, K); 29 Nov. 1958, *Th. Sørensen et al.* 6329 (BKF, C, K); 15 Dec. 1963, *Umpai* 142 (BKF); 7 Mar. 1979, *P.J. O'Connor & C. Niyomdham* 15,669 (AAU, BKF); 12 Nov. 2004, *P. Traiperm* 158 (BCU, BKF, KKU); 29 Oct. 2005, *P. Traiperm* 265 (BCU, BKF, KKU) 27 Mar. 2006, *P. Traiperm* 376 (BCU, BKF, KKU)].

Distribution.— Indo-China, Malesia.

Ecology.— Caespitose grass on open area in pine forest, altitude 1300 m. Flowering in October to March.

Notes.— At the base of the erect culm a tuft of leafless sheaths is found, the apices of which are sometimes blackened from burning. The species grows in savannahs, and is apparently fire-resistant, developing new shoots after the fire.

6. Hemarthria stolonifera Bor, Dansk Bot. Ark. 23: 163. 1965.— Type: Thailand: Chanthaburi, *K. Larsen* 10033 (holotype C!, isotype BKF!).

Perennial grass, stoloniferous. *Culms* creeping, slender 25–30 cm tall, prostrate, terete, internodes glabrous, nodes glabrous. *Leaf-sheaths* loose, pubescent, margins ciliate. *Ligules* membranous with ciliate hairs, *ca.* 0.8 mm long. *Leaf-blades* linear, 3–20 cm by 1.5–3 mm, glabrous on both surface sometimes with bulbous-based britles near mouth, margins scabrous, apex retuse. *Inflorescence* racemes, solitary, straight, terminal, 10–13 cm long, rachis internodes columnar, flattened, *ca.* 3 mm long, adherent to upper glume of sessile spikelet, glabrous, nodes glabrous. *Spikelets* oblong; the pedicel of the pedicelled spikelet and the internode of the rachis fused and together hollowed to accommodate the sessile spikelet. *Sessile spikelet* dorsally compressed. *Glumes*; lower glume elliptic-oblong, 5.5–6 mm long, 11-nerved, flattened, glabrous, apex obtuse; upper glume boat-shaped, *ca.* 6 mm long, 3-nerved, glabrous, apex acute. *Lower floret* barren; lemma oblong, *ca.* 4.5 mm long. Upper floret; lemma oblong *ca.* 3.9 mm long, hyaline. *Anthers* 2.5–3.5 mm long. *Pedicelled spikelet ca.* 7 mm long, callus glabrous. *Pedicels* flattened, slender, glabrous up to 20 mm long. *Glumes*; lower glume linear to lanceolate-acuminate, 6.5–7 mm long, 11–13-nerved, flattened, glabrous; upper glume boat-shaped, 7–7.5 mm long, 9-nerved, keeled scabrous, apex acuminate. *Lower floret*; lemma oblong, *ca.* 4.5 mm long. *Upper floret*; lemma *ca.* 4 mm long. *Anthers ca.* 3 mm long (Figs. 5.18 & 5.42G-I).

Thailand.— SOUTH-EASTERN: Chanthaburi [Plain of Makham, 13 Jun. 1963, *K. Larsen* 10033 (BKF, C)].

Distribution.— Endemic to Thailand.

Ecology.— Creeping on wet place, at sea level. Flowering in June.

Notes.— Known only from the type specimens and also reported that this species seems unique for its stoloniferous habit .

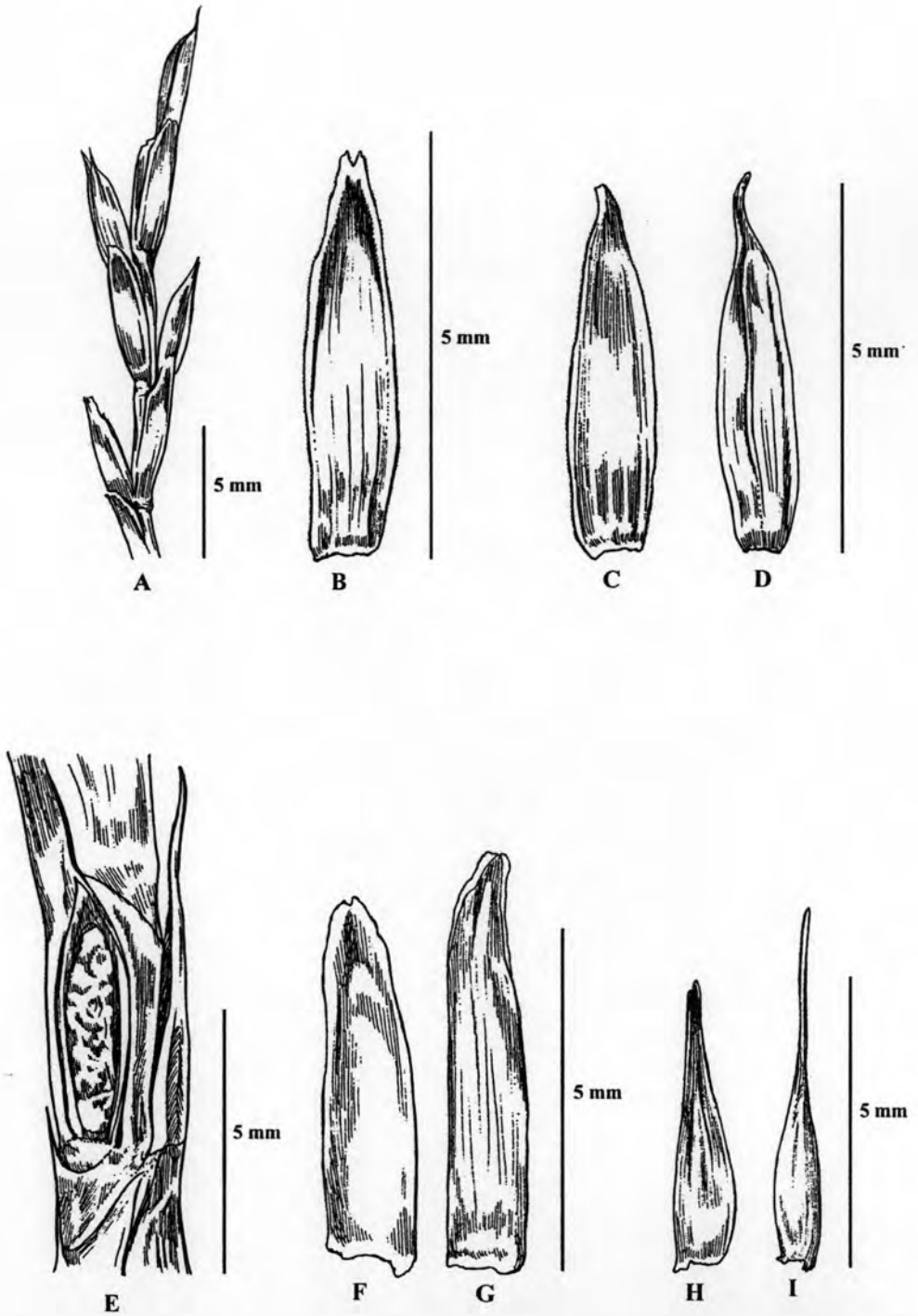

Figure 5.15 A-D. *Hemarthria altissima*: A. partial raceme; B. lower glume of the sessile spikelet; C. lower glume of the pedicelled spikelet; D. upper glume of the pedicelled spikelet. E-H. *H. compressa*: E. partial raceme; F. & G. lower glume of the sessile spikelet (two views); H. lower glume of the pedicelled spikelet; I. upper glume of the pedicelled spikelet.

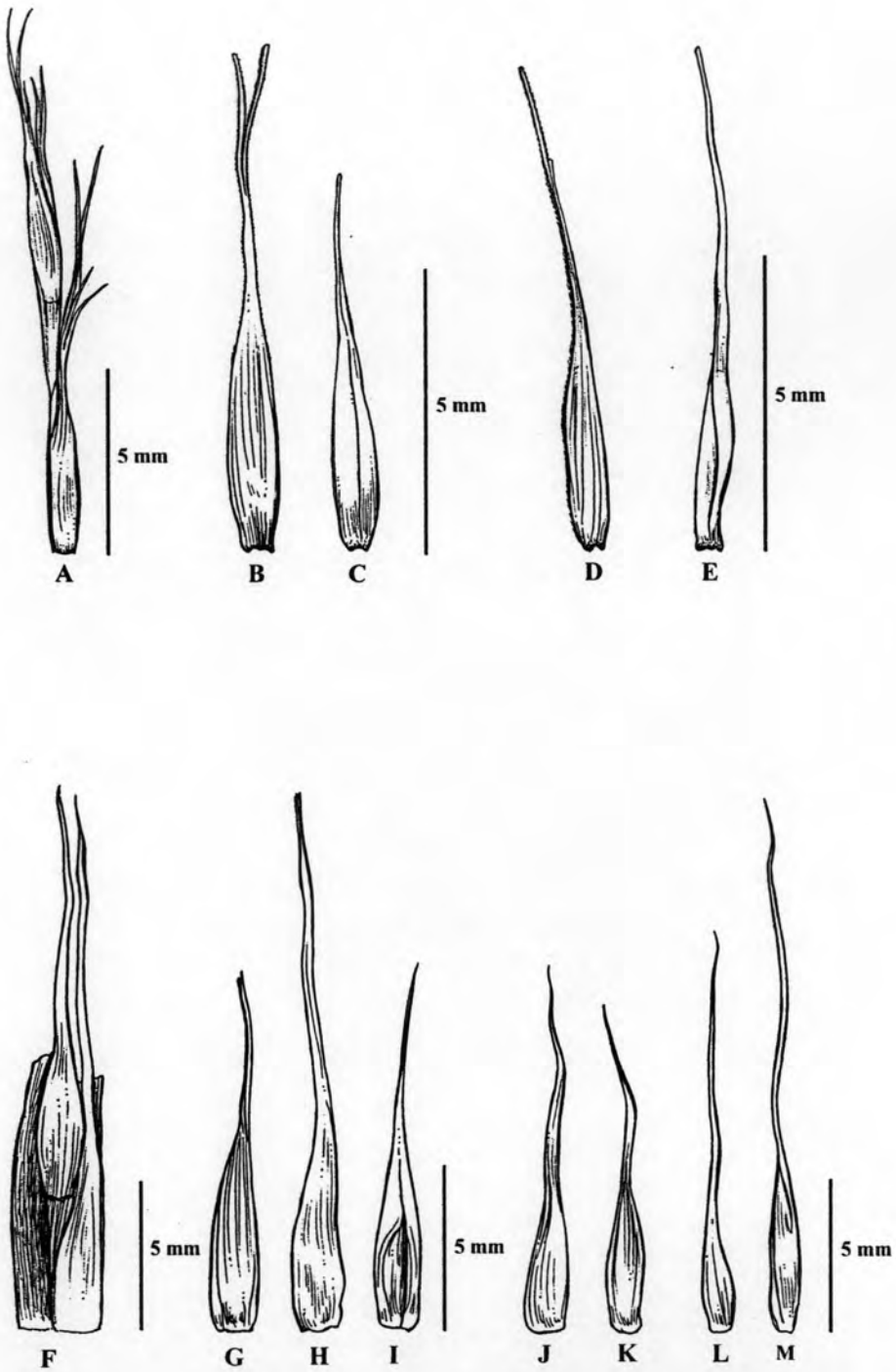

Figure 5.16 A-E. *Hemarthria debilis*: A. partial raceme; B. lower glume of the sessile spikelet; C. upper glume of the sessile spikelet; D. lower glume of the pedicelled spikelet; E. upper glume of the pedicelled spikelet. F-M. *H. longiflora*: F. partial raceme; G. & H. lower glume of the sessile spikelet (two views); I. upper glume of the sessile spikelet; J. & K. lower glume of the pedicelled spikelet; L. & M. upper glume of the pedicelled spikelet.

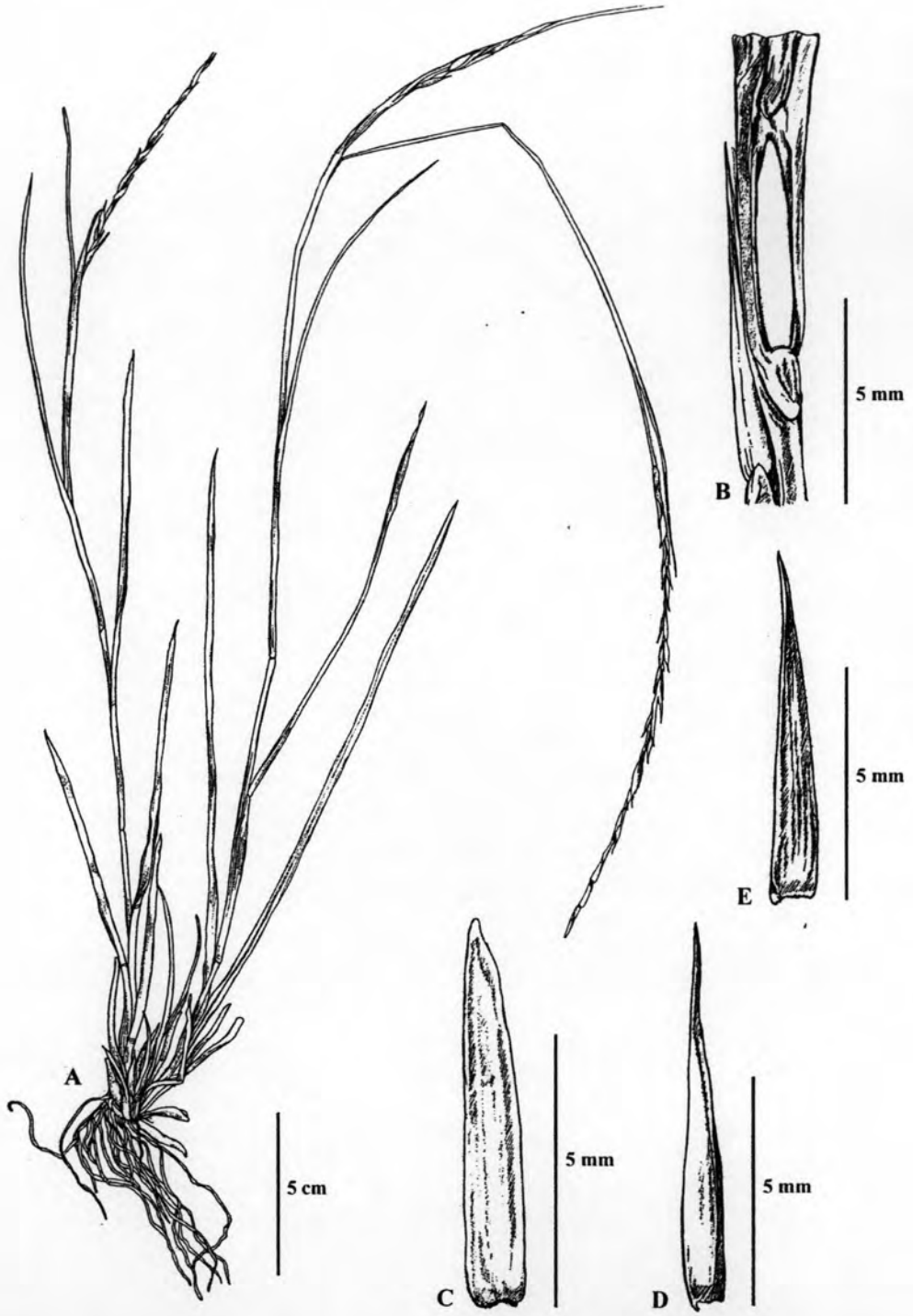

Figure 5.17 *Hemarthria pratensis*: A. plant; B. partial raceme; C. & D. sessile spikelet: C. lower glume, D. upper glume; E. lower glume of the pedicelled spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 158.

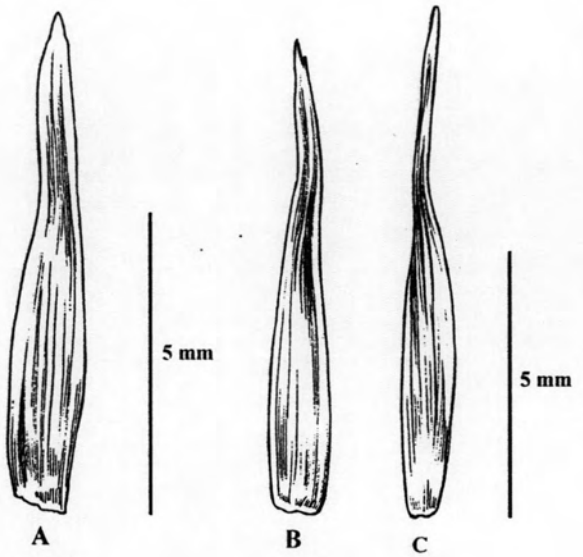

Figure 5.18 *Hemarthria stolonifera*: A. lower glume of the sessile spikelet; B. lower glume of the pedicelled spikelet; C. upper glume of the pedicelled spikelet.

4. MNESITHEA

Kunth, Rév. Gram. 1: 153. 1829.— Type species: *M. laevis* (Retz.) Kunth.

Coelorachis Brongn. in Duperr., Voy. Coq. Bot. Phan.: 64, f 14. 1831; Clayton in Kew Bull. 24: 309. 1970.— Type species: figure of *C. glandulosa* (Trin.) Ridl.

Rottboellia sect. *Apogonia* Nutt., Gen. N. Amer. Pl. 1: 83. 1818.— Type species: *R. rugosa* Nutt.

Diperium Desv., Opusc.: 76. 1831.— Type species: *D. cylindrical* Desv. (= *M. laevis*).

Thyridostachyum Nees in Lindl., Nat. Syst. Ed. 2: 379. 1836. *nom. superfl. pro. Mnesithea.*

Apogonia (Nutt.) Fourn., Mex. Pl. 2: 63. 1886.

Cycloteria Stapf in Ind. Lond. 5: 459. 1931. *nom nud.*— Type species: *C. selloana.*

Perennial, often robust with broad leaf-blades. *Leaf-sheath* tight. *Inflorescence* racemes, terminal or axillary and often spathate, a single cylindrical or flattened dorsiventral raceme, spikelets paired or occasionally in triplets of 2 sessile and 1 pedicelled, usually in three on below. *Sessile spikelet* paired or solitary, callus truncate with central peg. *Glumes*; lower glume oblong, coriaceous, winged or wingless, chartaceous to crustaceous, smooth, areolate or cancellate, 2-keeled, keels winged towards tip; upper glume awnless. *Lower floret* barren, with or without a small palea or absent. *Pedicelled spikelet* well developed or vestigial; pedicel free, clavate or foliaceous, sometimes auriculate at tip or rarely absent. *Pedicels* free from the internode, rarely fused to internode.

A genus of 8 species occurs in Thailand.

KEY TO THE SPECIES

1. Pedicelled spikelet absent **4. M. laevis**

1. Pedicelled spikelet present

2. Lower glume of the sessile spikelet with 4–7 upwardly directed hooks on each lateral keel **2. M. glandulosa**

2. Lower glume of the sessile spikelet entirely devoid of hooks
   3. Back of the lower glume of the sessile spikelet glabrous, smooth or continuous slits
      4. Joint at base with a ring of cilia **3. M. helferi**
      4. Joint at base glabrous
         5. Lower glume of the sessile spikelet ovate, indurate, 4.5–5 by *ca.* 1.5 mm, apex with 2 apical wings, continuous ridge along the length and interrupted by tubercles or tubercle-based hairs on the back or glabrous **6. M. striata**
         5. Lower glume of the sessile spikelet oblong, indurate, 5–5.5 by 1.2–1.5 mm, apex with unequal wings, 7–8 longitudinal rows of small pits between the nerves on the back, margins at base puberulous **8. M. sp.1**
   3. Back of the lower glume of the sessile spikelet scaberulous or hairy
      6. Lower glume of the sessile spikelet without apical or lateral wing **1. M. cancellata**
      6. Lower glume of the sessile spikelet with apical wings or wings along margins
         7. Back of the lower glume of the sessile spikelet with continuous ridge along the length and interrupted by hairs or tubercle-based hairs **5. M. mollicoma**
         7. Back of the lower glume of the sessile spikelet smooth and densely appressed hairs **7. M. thailandica**

1. Mnesithea cancellata Ridl., Fl. Mal. Pen. 5: 206. 1925.

Rottboellia cancellata Ridl., J. As. Soc. Straits 59: 228. 1911.— Type: Malay Peninsula, *H.N. Ridley* 15231 (holotype K!).

C. clathrata Henrard, Blumea 4: 519. 1941.— Type: Vietnam, Annam: Quinhon, *Balansa* s.n. (isotype L!).

R. foveolata Holtt., Gard. Bull. Singapore 11: 297. 1947.— Type: Malay Peninsula, *H.N. Ridley* 15231 (isotype K!).

Coelorachis foveolata (Holtt.) Jansen, Reinwardtia 2: 256. 1953.

C. cancellata (Ridl.) Bor, Dansk Bot. Ark. 20. 2: 168. 1962.

Perennial grass, caespitose. *Culms* erect, slender, up to 1 m tall, internodes terete, glabrous, nodes with a ring of short ciliate hairs. *Leaf-sheaths* loose, 5–10 cm long, glabrous except for the margins and nodes densely hairy. *Ligules* short membranous with long ciliate margins. *Leaf-blades* 10–40 by 0.5–0.8 mm, adaxial

surface slightly hairy, abaxial surface glabrous, margins scabrous, apex acute. *Inflorescence* racemes, 5–7 cm long, terminal and axillary, subtended by a spatheole, exserted, terete, rachis internodes oblong with cup-shaped transverse tip, 3–4 mm long, distinctly 6–7-nerved, glabrous, joint at base glabrous, spikelets oblong, dorsally compressed, 4-6 mm long, callus glabrous, base oblique with central peg. *Sessile spikelets* 3–4 mm long. *Glumes*; lower glume oblong-ovate, indurate, 3–3.5 by *ca.* 1.5 mm, cancellate on the back, apex wingless; upper glume boat-shaped, 2.5–3.5 by *ca.* 1 mm, 3-nerved, glabrous, keeled along the midnerved from base to apex on the back, keeled scabrous, apex acute. *Lower floret*; lemma oblong, 2–2.5 mm long, hyaline, folded; palea absent. *Upper floret*; lemma oblong, *ca.* 2 mm long, hyaline, folded. *Lodicules* cuneate, 0.7 mm long. *Ovary* elliptic, *ca.* 0.7 mm long. *Anthers* 1.2–1.5 mm long. *Pedicelled spikelet* reduced into 2 asymmetrical glumes, *ca.* 1.5–2.5 mm long. *Pedicels* ribbon-like 2.5–3 mm long, distinctly 2 green lines, glabrous (Figs. 5.19A-D & 5.43A. & B).

Thailand.— NORTHERN: Chiang Mai [Doi Suthep, Wang Bua Ban, 11 Aug. 1987, *J.F. Maxwell* 87-856 (CMU)]; NORTH-EASTERN: Loei [Phu Kradueng, 23 Mar. 1954, *T. Smitinand* 1792 (BKF, K); 20 Mar. 1958, *Th. Sørensen et al.* 2349 (BKF, C, E, K); 12 Nov. 2004, *P. Traiperm* 161 (BCU, BKF, KKU); Phu Ruea, 17 Apr. 1968, *C. Chermsirivathana* 943 (BK); 24 Jul. 2004, *P. Traiperm* 122 (BCU, BKF, KKU); 4 Dec. 2004, *P. Traiperm* 188 (BCU, BKF, KKU); 28 Mar. 2006, *P. Traiperm* 379 (BCU, BKF, KKU); Phu Luang, 15 Nov. 1968, *C. Chermsirivathana* 1092 (BK)], Sakon Nakhon [Phu Phan National Park, 3 Oct. 2005, *P. Traiperm* 202 (BCU, BKF, KKU), 205 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [15 km NE of Chaiyaphum, 14 Aug. 1972, *K. Larsen et al.* 31830 (AAU, BKF, K, L); Phu Khiao, 27 Nov. 2004, *P. Traiperm* 183 (BCU, BKF, KKU); Tat Tone National Park, 1 Jan. 2006, *P. Traiperm* 370 (BCU, BKF, KKU)], Nakhon Ratchasima [Huai Thalaeng, 24 Dec. 1928, *Put* 2238 (K)], Si Sa Ket [Dongrak Range at Chong Bat Lak, Kantharalak, 17 Aug. 1976, *J.F. Maxwell* 76-520 (AAU, BK, L)], Ubon Ratchathani [Km 81 on road 217 E of Warin Chamrap, 27 Oct. 2001, *S. Laegaard et al.* 21833 (AAU); Pha Taem National Park, 23 Oct. 2005, *P. Traiperm* 239 (BCU, BKF, KKU)].

Distribution.— Indo-China, Malesia.

Ecology.— Grass in rather dense tussock, in open dry deciduous forest, wet and sandy soil, at 50-1,300 m altitude. Flowering in July to April.

Notes.— *Mnesithea cancellata* is very close to *M. mollicoma*, but differing in the cancellate and wingless at the lower glume of the sessile spikelet, whereas the lower glume of *M. mollicoma* is continuous ridge along the length and interrupted by hairs or tubercle-based hairs and having unequal narrow wings along margins.

2. Mnesithea glandulosa (Trin.) Koning & Sosef., Blumea 31 (2): 290. 1986.

Rottboellia glandulosa Trin., Mem. Acad. Sci. Petersb. 6 (2): 250. 1832.— Type: Java, *Hb. Trinius* s.n. (holotype LE).

Manisuris glandulosa (Trin.) O. Ktze., Rev. Gen. Pl. 2: 780. 1891.

Coelorachis glandulosa (Trin.) Stapf ex Ridl., Fl. Mal. Penins. 5: 204. 1925.

R. muricata var. *javanica* Retz.— Type: Indonesia: Java, *Junghuhn, F.W.* s.n. (lectotype K!).

Perennial grass. *Culms* erect, a large stout tufted with prop roots below, up to 1–2 m tall, internodes glabrous or glabrescent, nodes with a ring of short ciliate hairs. *Leaf-sheaths* tight, glabrous, 8–20 cm long. *Ligules* a membranous with ciliolate hairs, 1–1.5 mm long. *Leaf-blades* lanceolate, *ca.* 100 by 1.5–3.5 cm, slightly appressed hairs on both surfaces, margins scabrous, round to a subcordate base, acuminate at the apex. *Inflorescence* racemes, 7–10 cm long, terminal and axillary, subtended by a spatheole, exserted, terete, rachis internodes cupuliform, 3–4 mm long, scabrous, joint at base scabrous, spikelets oblong, dorsally compressed, 5-6 mm long, callus scabrous, base truncate with central peg. *Sessile spikelets* 5–5.5 mm long. *Glumes*; lower glume oblong-ovate to ovate, 4-5.5 mm long, obscurely 6–7-nerved, glabrous on the back and with hooks on each lateral side in the basal part, margins enfold apex acute with 2-apical wings; upper glume boat-shaped, 4–4.5 mm long, chartaceous, glabrous, keeled along the midnerve from base to apex on the back, keeled scabrous, apex acute. *Lower floret* barren; lemma ovate-acute, 3–3.5 mm long, 3-nerved, hyaline, ciliolate on margins, enfolded; palea *ca.* 0.6 mm long. *Upper florets* fertile; lemma elliptic, 2–2.5 mm long, 3-nerved, hyaline; palea *ca.* 0.7 mm long. *Anthers* 3, *ca.* 2.5 mm long, purple. *Lodicules* cuneate, *ca.* 0.5 mm long. *Stigmas* 2. *Pedicelled spikelet* reduced to 2 glumes. *Pedicels* ribbon-shaped, 6–6.5 by *ca.* 1.5 mm, 7-nerved, comprising 2 subequal glumes. *Glumes*; lower glume ovate, *ca.* 1.5 mm long, winged along one side; upper glume more reduce (Figs. 5.19E-G & 5.43C-E).

Thailand.— NORTHERN: Chiang Mai [Doi Suthep, 22 Jul. 1911, *A.F.G. Kerr* 1912 (BM, K); 14 Sept. 1958, *Th. Sørensen et al.* 4989 (BKF, C, K); Huai Kaew, 8 Dec. 1980, *Y. Paisooksantivatthana* y 470-80 (BK)]; NORTH-EASTERN: Phetchabun [Nam Nao National Park, 17 Nov. 2005, *P. Traiperm* 279 (BCU, BKF, KKU)], Khon Kaen [Mancha Khiri, 24 Aug. 2005, *P. Traiperm* 210 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [Tat Tone waterfalls, 9 Oct. 1965, *S. Sutheesorn* 573 (BK)]; SOUTH-WESTERN: Kanchanaburi [Ban Din So, 16 Jul. 1926, *Put* 144 (BK, BM, K); Kin Sayok, 17 Jul. 1946, *A. Kostermans* 1141 (P)]; CENTRAL: Saraburi [Sam Lan waterfalls, 15 Jun. 1974, *J.F. Maxwell* 74-596 (AAU, BK, L); *C. Chermsirivathana* 622 (BK); 5 Nov. 2005, *P. Traiperm* 274 (BCU, BKF, KKU)], Nakhon Nayok [27 Jul. 1950, *K. Suvathabhandhu* 448 (BK); Nang Rong, 29 Jul. 1959, *T. Smitinand* 6086 (BKF); Wang Takrai, 27 Sept. 1969, *C. Chermsirivathana* 1562 (BK, L)], Krung Thep Maha Nakhon [25 Jul. 1920, *A.F.G. Kerr* 4360 (C, K)]; SOUTH-EASTERN: Sa Kaeo [Aranyaprathet, 9 Aug. 1930, *A.F.G. Kerr* 19603 (BK, BM, K); Klong Nam Sai, 18 Nov. 1964, *S. Sutheesorn* 173 (BK)], Prachin Buri [Ban Bung Hills, 17 Jul. 1963, *K. Larsen* 10639 (C, K); Khao Yai National Park, 10 Jul. 1966, *K. Larsen et al.* 246 (AAU, K)], Chon Buri [Bang Saen, 22 May 1919, *Nur* 4247 (K)], Chanthaburi [Ban Thale, Pong Nam Ron, 28 Nov. 1956, *T. Smitinand* 3667 (BKF)]; PENINSULAR: Chumphon [Khao Lard, Mueang, 1 Jan. 1974, *S. Sutheesorn* 2757 (BK)], Surat Thani [Ban Ta Por, Ta U Tae, 2 Feb. 1987, *P. Tepuarin* 350 (PSU)], Phangnga [Khlong Nang Yon, 28 Apr. 1973, *R. Geesink & T. Santisuk* 5004 (AAU)], Nakhon Si Thammarat [Kiriwong, Tap Chang, 28 Aug. 1951, *T. Smitinand* 765 (K)], Phatthalung [Khao Pu Khao Ya National Park, 21 Oct. 2004, *P. Traiperm* 139 (BCU, BKF, KKU)], Trang [Khao Chong, 9 Oct. 1970, *Ch. Charoenphol et al.* 3507 (AAU, BKF, K); Ton The waterfalls, 14 Nov. 1990, *K. Larsen et al.* 41374 (AAU, BKF, PSU)], Satun [Tarutao National Park, Malacca Creek to Talo Oo Dang, 13 Dec. 1979, *G. Congdon* 253 (AAU, PSU); 27 Jan. 1980, *G. Congdon* 289 (AAU, PSU); 31 Jul. 1980, *G. Congdon* 819 (AAU, PSU)], Songkhla [2 Dec. 1975, *A. Yiamudom* 18 (PSU); Suan Toon Falls, 16 Nov. 1984, *J.F. Maxwell* 84-439 (BKF, PSU); Mueang, 8 Oct. 1990, *B. Aksorn* 30 (PSU); Ton Pliew near Ton Nga Chang, 13 Oct. 1991, *K. Larsen et al.* 42369 (AAU); Khao Chum Sak at Hat Yai, 12 Aug. 1995, *K. Larsen et al.* 45494 (AAU); Khao Khor Hong, 18 Oct. 2004, *P. Traiperm* 134 (BCU, BKF, KKU)], Pattani [Sai Buri, 4 Aug. 1970, *S.*

Sutheesorn 1820 (BK)], Narathiwat [Bacho, 10 Jan. 1969, *P. Sankhachand* 1677 (BK)].

Distribution.— Indo-China, Malesia.

Ecology.— Grass common by on sandy bank by stream or edge of deciduous forest, up to 1,100 m altitude. Flowering in May to January.

Vernacular.— Ya khao pa (หญ้าข้าวป่า) (Kanchanaburi).

Notes.— This species is easily recognised by hooks on each lateral side in the basal part of the lower glume of the sessile spikelet.

3. Mnesithea helferi (Hook.f.) Koning & Sosef., Blumea 31 (2): 291. 1986.

Rottboellia helferi Hook.f., Fl. Brit. Ind. 7: 158. 1896.— Type: India, *Helfer* 913 (holotype K!).

Mnesithea rupincola Ridl., J. Roy. As. Soc. Str. Br. 57: 116. 1911.— Type: Malay Peninsula, Perak, *H.N. Ridley* 14357 (syntype K!).

Coelorachis helferi (Hook.f.) Henr., Blumea 4: 518. 1941.

Perennial grass, caespitose, with a young propagule below. *Culms* erect, 50–100 cm tall, internodes glabrous to pilose, nodes pubescent. *Leaf-sheaths* tight, 6–10 cm long, glabrous to pilose. *Ligules* membranous, 0.5–0.8 mm long. *Leaf-blades* 15–50 by 0.8–1.5 cm, glabrous to pubescent on both surfaces, margins scabrous and pilose, acuminate at apex. *Inflorescence* composed of racemes, 9–12 cm long, terminal and axillary, subtended by a spatheole, rachis internodes cupuliform on upper part, basal part cuneate, glabrous, nodes with a ring of long cilia; spikelets in pairs or tripets, 1–2 sessile spikelets and 1 pedicelled spikelet, callus long pilose, base truncate with central peg. *Sessile spikelets* dorsally compressed. *Glumes*; lower glume ovate, indurate, 3–3.5 by 1–1.2 mm, glabrous on the back, margins entire, sometimes pilose on the lower part, apex bifid with oblique, 2 apical wings, wing unequal, the biggest wing usually along the apex to the base; upper glume ovate, 2.5–3 by *ca.* 1 mm, 3–nerved, keeled along the midnerve from base to the apex, glabrous on the back, apex acute. *Lower floret*; lemma ovate, *ca.* 2 by 0.8 mm, hyaline, folded; palea absent. *Upper floret*; lemma ovate, *ca.* 2.5 by 1.5 mm, hyaline. *Lodicules* cuneate, 0.5 mm long. *Anthers ca.* 2 mm long. *Pedicelled spikelet* oblong, 0.5–0.8 mm long,

reduced into 2 asymmetrical glumes. *Pedicels* ribbon-like, *ca.* 3 by 0.5 mm, distinctly 2 green lines, glabrous, apex truncate and curved (Figs. 5.19H-K and 5.44A. & B).

Thailand.— NORTH-EASTERN: Loei [Phu Ruea, 23 Apr. 2005, *P. Traiperm* 201 (BCU, BKF, KKU)], Nong Khai [Chet Si Falls, Phu Wua Wildlife Sanctuary, 26 Aug. 2001, *R. Pooma et al.* 2718 (L)], Sakon Nakhon [Phu Phan National Park, 29 Aug. 2004, *P. Traiperm* 123 (BCU, BKF, KKU); 6 Nov. 2004, *P. Traiperm* 153 (BCU, BKF, KKU); 3 Oct. 2005, *P. Traiperm* 203 (BCU, BKF, KKU)], Khon Kaen [Mancha Khiri, 24 Aug. 2005, *P. Traiperm* 209 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [Phu Khiao, 19 Oct. 2005, *P. Traiperm* 225 (BCU, BKF, KKU)], Si Sa Ket [Dongrak range, 31 Dec. 2005, *P. Traiperm* 363 (BCU, BKF, KKU); Phu La-or waterfalls, 31 Dec. 2005, *P. Traiperm* 364 (BCU, BKF, KKU)], Ubon Ratchathani [km 10, 2112 road to Khong Chiam, 23 Oct. 2005, *P. Traiperm* 252 (BCU, BKF, KKU)]; SOUTH-WESTERN: Kanchanaburi [Sai Yok, 1 Aug. 1928, *A. Marcan* 2367 (BM, K)], Prachuap Khiri Khan [Huai Yang, 2 Jul. 1924, *A.F.G. Kerr* 10745 (BK, K)]; CENTRAL: Saraburi [Sam Lan forest, Mueang, 15 Jun. 1974, *J.F. Maxwell* 74-586 (AAU, BK, L)]; SOUTH-EASTERN: Chanthaburi [Plain of Makham, 22 Aug. 1966, *K. Larsen et al.* 1682 (AAU)]; PENINSULAR: Songkhla [Hat Yai, 18 Oct. 2004, *P. Traiperm* 132 (BCU, BKF, KKU); Ton Lad waterfalls, 19 Oct. 2004, *P. Traiperm* 136 (BCU, BKF, KKU); Ton Tad Pha waterfalls, *P. Traiperm* 137 (BCU, BKF, KKU)].

Distribution.— Indo-China, Malesia.

Ecology.— Tufted grass in evergreen, deciduous forest or swampy area at 25-200 m altitude. Flowering in April to December.

Notes.—The collections of *A.F.G. Kerr* 10745 having a glabrous rachis nodes.

4. Mnesithea laevis (Retz.) Kunth in Rev. Gram. 1. 154.

Rottboellia laevis Retz., Obs. Bot. 3: 11. 1783.— Type: India, *Wight* 1722 (isotype K!).

Ophiuros undatus Nees, Hook. Kew Journ. 2. 1850.— Type: Philippines, Luzon, *Cumming, H.* 1339 (holotype K!, isotypes L!, P!).

Mnesithea laevis var. *hirta* (Retz.) Kunth in Révis. Gramin. 1: 154.— Type: Indonesia, Sulawesi, Saloe Karadjoe, *P.J. Eyma* 361 (isotype L!).

Perennial grass, tufted. *Culms* slender, erect, 30–100 cm long, terete, glabrous. *Leaf-sheath* tight, 4–7 cm long, glabrous, upper part with long ciliate hairs at margins. *Ligules* an eciliate membrane, *ca.* 0.5 mm long. *Leaf-blade* linear, incurved, 15–70 by 0.2–0.5 cm, glabrous on both sides, abruptly acute. *Inflorescence* racemes, terminal or axillary, 7-21 cm long, rachis internodes cuneate, 3.5–4 mm long, apex crateriform; spikelets sunken, arranged in two or three, usually in three on below. *Sessile spikelets* paired or solitary, oblong; dorsally compressed. *Glumes*; lower glume oblong, 3–3.5 by *ca.* 1 mm, coriaceous, glabrous, apex obtuse, wingless; upper glume oblong, *ca.* 3 by 1 mm, membranous, slightly enfolded, obtuse at apex. *Lower floret*; lemma lanceolate, 2.5–2.8 mm long, hyaline; palea absent. *Upper floret*; lemma lanceolate, *ca.* 2.8 mm long, hyaline; palea absent. *Pedicelled spikelet* absent. *Pedicels* fused to internode, united wholly (Figs. 5.20 & 5.44C-E).

Thailand.— NORTHERN: Chiang Mai [Doi Inthanon, *ca.* 5 km from Chom Thong, 3 Oct. 2001, *S. Laegaard & M. Norsaengsri* 21657 (AAU, K, L), 15 Oct. 2001, *S. Laegaard & M. Norsangsri* 21713 (AAU); 24 Nov. 2005, *P. Traiperm* 307 (BCU, BKF, KKU); along road; Op Luang table-land, 12 Jun. 1968, *C.F. van Beusekom & C. Phengklai* 1192 (C, E, K, L, P)], Sukhothai [N Sukhothai, between Tak and Ban Dan Lan Hoi, 24 Jul. 1973, *G. Murata et al.* 16988 (L)], Kamphaeng Phet [20 Jul. 1959, *T. Smitinand* 5960 (BKF, K)], Nakhon Sawan [10 km NW of Nakhon Sawan, 21 Jul. 1973, *G. Murata et al.* T-16580 (BKF, L, P)]; NORTH-EASTERN: Loei [Phu Kradueng, Ban Na Noi To Na Noi station, 26 Aug. 1988, *H. Koyama T*-61335 (BKF)], Nong Khai [Dong Si chompu, 22 Jun. 1963, *Adisai* 550 (BK)], Khon Kaen [Ban Nawng Khuean, 7 Jul. 1967, *T. Smitinand* 10406 (BKF)]; EASTERN: Chaiyaphum [Nong Bua Daeng, 15 Aug. 1972, *K. Larsen et al.* 31888 (AAU, L)], Nakhon Ratchasima [Huai Thalaeng, 24 Dec. 1828, *Put* 2239 (K); 20 Aug. 2001, *R. Pooma et al.* 2119 (L)], Buri Ram [40 km S of Buriram, along route, 4 Oct. 1984, *G. Murata et al.* T-37457 (BKF, L)], Surin [Kap Choeng, 20 May 1965, *S. Sutheesorn* 305 (BK); Thung Kula Rong Hai: Chumphon Buri, 7 Sept. 1972, *S. Sutheesorn* 2117 (BK)]; SOUTH-WESTERN: Kanchanaburi [Khao Tawng, 31 Aug. 1930, *A.F.G. Kerr* 19649 (BK, BM, K)], Prachuap Khiri Khan [Khao Yai, 8 Nov. 1927, *A.F.G. Kerr* 13508 (BK, BM, K); Klong Wan, 21 Oct. 1964, *C. Chermsirivathana* 120 (BK)]; SOUTH-EASTERN: Sa Kaeo [Aranyaprathet, 9 Aug. 1930, *A.F.G. Kerr* 19584 (BK, BM, K)]; Chon Buri [Khao Khiao, 26 Apr. 1975, *J.F.*

Maxwell 75-433 (AAU, BK, L)]; PENINSULAR: Surat Thani [Kanchanadit, 1 Aug. 1927, *A.F.G. Kerr* 13085 (BK, BM, K)], Phatthalung [Sak, 30 Apr. 1930, *A.F.G. Kerr* 19253 (BK, BM, K)], Songkhla [Thepa, 23 Mar. 1928, *A.F.G. Kerr* 14720 (BM, K); 4 Dec. 1975, *A. Yiamudom* 27 (PSU); Songkhla-Pattani road, 55 km from Songkhla, 31 Oct. 1990, *K. Larsen et al.* 41021 (AAU, PSU); highway 4, near Pru village, 8 Aug. 1994, *J.F. Maxwell* 84-8 (PSU); 23 km E of Chana, 21 Aug. 1995, *K. Larsen et al.* 45821 (AAU, L); Suan Dtoon falls, 11 Oct. 1984, *J.F. Maxwell* 84-306 (BKF, PSU); 1 Nov. 1993, *K. Larsen et al.* 44202 (AAU); Khao Chum Sak at Hat Yai, 12 Aug. 1995, *K. Larsen et al.* 45502 (AAU, L)], Narathiwat [Rueso, 10 Nov. 1970, *S. Sutheesorn* 1843 (BK)].

Distribution.— India, China, Indo-China.

Ecology.— Dry deciduous, dipterocarp, bamboo or pine forest, up to 400 m altitude. Flowering in July to May.

Notes.—*A.F.G. Kerr* 13508 has a longitudinal slit on the back of the lower glume of the sessile spikelet.

5. Mnesithea mollicoma (Hance) A. Camus, Bull. Mus. Hist. Nat. Paris 25: 57. 1919.

Rottboellia mollicoma Hance, J. Bot. 9: 134. 1871.— Type: China, *Hance* 7558 (holotype, isotype and syntype K!, isotype BM!).

Mnesithea pubescens Ridl., Journ. As. Soc. Straits, xliv. 44: 207. 1905.— Type: Malay Peninsula, *H.N. Ridley* 11017 (holotype K!).

Coelorachis mollicoma (Hance) Bor, Dansk. Bot. Ark. 20: 169. 1962.

Perennial grass, caespitose, with a young propagule. *Culms* erect, 30–100 cm tall, internodes pilose with appressed hairs, nodes pubecsent. *Leaf-sheaths* loose, 6–10 cm long, pubescent. *Ligules* membranous with long ciliate margins, *ca.* 1–1.5 mm long. *Leaf-blades* 20–60 by 0.8–1.8 cm, pubescent on both surfaces, apex acute. *Inflorescence* composed of racemes, 8–14 cm long, terminal and axillary, subtended by a spatheole, rachis internodes cupuliform on upper part, basal part cuneate, glabrous, nodes with a ring of ciliate hairs; spikelets in pairs or tripets, callus pubescent. *Sessile spikelets*; lower glume oblong-ovate, indurate, 3.5–4.5 by 1.8–2 mm, subequal narrow winged along margins, continuous ridge along the length and interrupted by hairs or tubercle-based hairs; upper glume ovate or boat-shaped, *ca.* 3.5 by 1 mm, 3-nerved, keeled along the upper back, glabrous, apex acute. *Lower floret*;

lemma ovate, *ca.* 2.5 by 1 mm, hyaline, folded; palea absent. *Upper floret*; lemma ovate, *ca.* 3 by 2 mm, 3-nerved, hyaline; palea ovate, *ca.* 2.8 by 1 mm, hyaline. *Lodicules* cuneate, 0.5 mm long. *Anthers ca.* 2 mm long. *Pedicelled spikelet* ovate, 0.5–1.5 mm long, reduced into 2 asymmetrical glumes. *Pedicels* oblong or ribbon-like, 3–4.5 by 0.5–0.8 mm with distinctly 2 green lines, glabrous, apex truncate, curved (Figs. 5.21A-D & 5.45A-C).

Thailand.— NORTHERN: Chiang Mai [Along the highway between Mae Saring and Chom Thong, 19 Sept. 1967, *K. Iwatsuki & N. Fukuoka* T-10393 (BKF, E, L); Doi Suthep, 23 Jul. 1958, *Th. Sørensen et al.* 4377 (C, E, K); 27 Jul. 1958, *Th. Sørensen et al.* 4494 (C, K); 30 Aug. 1958, *Th. Sørensen et al.* 4629 (C, K); 10 May 1958, *Th. Sørensen et al.* 5463 (C); 9 Dec. 1965, *T. Smitinand* 10006 (BKF); 18 Sept. 1967, *T. Shimizu et al.* T-10473 (BKF, L); 22 Aug. 1987, *J.F. Maxwell* 87-856 (BKF, L), 87-1020 (BKF, CMU, L), 88-1106 (BKF, CMU, L); 92-622 (L, P); 93-19 (L, P); Mae Klang river, Doi Inthanon, 3 Aug. 1988, *H. Koyama* T-61213 (BKF, L), T-61248 (BKF), T-61625 (AAU, BKF, L); 3 Aug. 1988, *S. Tsugaru* T-61849 (AAU, BKF, L); 14 Jun. 2004, *P. Traiperm* 112 (BCU, BKF, KKU), 113 (BCU, BKF, KKU); 22 Nov. 2005, *P. Traiperm* 296 (BCU, BKF, KKU); 24 Nov. 2005, *P. Traiperm* 305 (BCU, BKF, KKU); Forest above Training Center of Queen Sirikit Botanical Garden, 9 Oct. 2001, *S. Laegaard & M. Norsaengsri* 21688 (AAU, L)], Lamphun [en route from Ban Khun Tan to Doi Khun Tan, 9 Apr. 1967, *M. Tagawa et al.* T-9205 (BKF); Mae Tah, 28 Jul. 1994, *J.F. Maxwell* 94-808 (L)], Lampang [Khun Tan, 4 Dec. 2005, *P. Traiperm* 320 (BCU, BKF, KKU)]; NORTH-EASTERN: Phetchabun [Nam Nao National Park, 17 Nov. 2005, *P. Traiperm* 280 (BCU, BKF, KKU)], Loei [Phu Ruea, 24 Jul. 2004, *P. Traiperm* 117; 28 Mar. 2005, *P. Traiperm* 378 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [Phu Khiao, 27 Nov. 2004, *P. Traiperm* 182 (BCU, BKF, KKU); Phu Lanka, 1 Jan. 2006, *P. Traiperm* 368 (BCU, BKF, KKU)], Nakhon Ratchasima [Huai Thalaeng, 12 Dec. 1928, *Put* 2238 (BK, BM)]; SOUTH-EASTERN: Chanthaburi [Makham, 4 Aug. 1954, *T. Smitinand* 1827 (BKF, K); 22 Aug. 1966, *K. Larsen et al.* s.n. (BKF); 19 Nov. 2005, *P. Traiperm* 290 (BCU, BKF, KKU)]; PENINSULAR: Surat Thani [6 Jan. 1927, *A.F.G. Kerr* 11282 (BK, BM, K); Kanchanadit, 1 Aug. 1927, *A.F.G. Kerr* 13074 (BK, K)], Trang [Thung Kai, 22 Oct. 2004, *P. Traiperm* 141 (BCU, BKF, KKU)], Songkhla [Koh Hong, Hat Yai, 18 May 1960, *C. Chantaraprasong* 25 (BK); 11 Aug. 1984, *J.F. Maxwell* 84-33 (BKF, PSU);

Hat Yai, 18 Oct. 2004, *P. Traiperm* 131 (BCU, BKF, KKU); 23 km E of Chana, 21 Aug. 1995, *K. Larsen et al.* 45819 (AAU, L)].

Distribution.— China, Indo-China, Malesia.

Ecology.— Tufted grass common in mixed deciduous forest, at sea level to 1,200 m altitude. Flowering throughout the year.

6. Mnesithea striata (Nees ex Steud.) Koning & Sosef., Blumea 31 (2): 292. 1986.

Rottboellia striata Nees ex Steud., Syn. Pl. Glum. 1: 361. 1855.— Type: *Wall. Cat. no.* 8877 C (lectotype K!).

R. merguensis Hook.f., Fl. Brit. India 7: 158. 1897.— Type: Burma, Tenasserim, Mergui, *Helfer, J.W.* 457 (holotype L!), *Griffith* s.n. (syntype K!).

M. merguensis (Hook.f.) A. Camus, Bull. Mus. Hist. Nat. Paris. 25: 59. 1919.

Coelorachis striata (Nees ex Steud.) A. Camus, Ann. Soc. Linn. Lyon. 68: 197. 1921.

KEY TO THE VARIETIES

1. Leaf-blades glabrous on both surfaces; lower glume of the sessile spikelet glabrous or nearly smooth on the back **a. var. striata**
1. Leaf-blades pubescent on both surfaces; lower glume of the sessile spikelet with continuous ridges along the length and interrupted by tubercles or tubercle-based hairs, margins glabrous **b. var. pubescens**

a. var. striata

Perennial grass, caespitose, large stout tufted with propagules below. *Culms* erect, up to 2 m tall, terete, internodes glabrous, nodes slightly hairy or glabrescent. *Leaf-sheaths* nearly tight, 5–12 cm long, glabrous, margins pilose. *Ligules* membranous with ciliate margins, 1.5–2 mm long. *Leaf-blades* 30–60 by 1–2 cm, glabrous on both surfaces, margins scabrous and pilose, apex acute. *Inflorescence* composed of many racemes, 8–12 cm long, terminal and axillary, subtended by a spatheole, rachis internodes oblong, flattened at base swollen at the upper part, 4–6.5 by *ca.* 1 mm, glabrous, nodes glabrous; spikelets in pairs or tripets, callus glabrous. *Sessile spikelets* dorsally compressed. *Glumes*; lower glume oblong, indurate, 3.5–5

by 1–1.5 mm, glabrous or nearly smooth on the back, apex with 2 small apical wings; upper glume boat-shaped, acute, 3–4 by 1–1.5 mm, keeled on the back, on the upper part, glabrous. *Lower floret*; lemma ovate-acute, *ca.* 2.8 by 0.8 mm, 3-nerved, hyaline, glabrous; palea lanceolate, *ca.* 2 by 0.5 mm, hyaline, glabrous. Upper floret; lemma ovate-acute, *ca.* 2.8 by 0.8 mm, hyaline, glabrous; palea boat-shaped, *ca.* 2.5 by 0.5 mm, hyaline, glabrous, apex acute. *Lodicules* cuneate, 0.5 mm long. *Anthers* 1.8-2 mm long. *Pedicelled spikelet* oblong or ovate, 1–2.5 mm long, reduced into 2 asymmetrical glumes, glumes dissimilar, winged at the apex, slightly folded, glabrous. *Pedicels* oblong or ribbon-like 3.5–4.5 by *ca.* 1 mm, with distinct 2 green lines, glabrous, apex concave (Figs. 5.21E-J & 5.45D-F).

Thailand.— NORTHERN: Chiang Mai [Mae Sa Valley, *J.K. Jackson* 6165 (BKF); Doi Suthep, 22 Jun. 1958, *Th. Sørensen et al.* 3689 (C, K); 7 Jan. 1993, *J.F. Maxwell* 93-18 (L, P); 22 Nov. 2005, *P. Traiperm* 298 (BCU, BKF, KKU); Doi Pui, 24 Mar. 1965, *C.H. & B.S.* 305 (BKF); Pangboh, Hill E of camp, 3 Nov. 1965, *T. Smitinand* 8715 (BKF); 15 Oct. 1992, *J.F. Maxwell* 92-622 (P); Wang Tao, N of Chiang Mai, 13 Feb. 1958, *Th. Sørensen et al.* 1080 (K); Doi Inthanon, en route from Pha Mon (Ban Yang) to the camp, 10 Feb. 1971, *G. Murata et al.* T-15870 (BKF); along Mae Klang river, 3 Aug. 1988, *H. Koyama* T-61213 (L); 30 Jul. 1988, *H. Koyama* T-61625 (AAU, L); 3 Aug. 1988, *S. Tsugaru* T-61849 (AAU, L); Tham Chiang Dao, 16 Feb. 1958, *Th. Sørensen et al.* 1161 (C); Doi Chiang Dao, 1 Jun. 1966, *M. Tagawa et al.* T-4416 (BKF); Wieng Pa Pao, Doi Luang National Park, 26 Oct. 1997, *J.F. Maxwell* 97-1223 (BKF, L); above Training Center of Queen Sirikit Botanical Garden, 24 Sept. 2001, *S. Laegaard* 21613 (AAU); 5 Oct. 2001, *S. Laegaard* 21677 (AAU)], Lamphun [Mae Tah, 24 Sept. 1993, *J.F. Maxwell* 93-1081 (BKF, L)], Lampang [Chae Son National Park, 20 Oct. 1995, *J.F. Maxwell* 95-924 (BKF, L); Khun Tan, 4 Dec. 2005, *P. Traiperm* 325 (BCU, BKF, KKU)], Tak [Doi Musoe, 12 Sept. 1960, *T. Smitinand* 7081 (BKF)], Sukhothai [Khao Luang, 17 Dec. 2005, *P. Traiperm* 343 (BCU, BKF, KKU), 344 (BCU, BKF, KKU), 345 (BCU, BKF, KKU)]; NORTH-EASTERN: Phetchabun [Nam Nao, 20 Aug. 2004, *P. Traiperm* 121 (BCU, BKF, KKU); 20 Nov. 2004, *P. Traiperm* 172 (BCU, BKF, KKU), 173 (BCU, BKF, KKU); Phu Khiao, 19 Oct. 2005, *P. Traiperm* 211(BCU, BKF, KKU), 223 (BCU, BKF, KKU)], Loei [Phu Kradueng, 12 Nov. 2004, *P. Traiperm* 156 (BCU, BKF, KKU)], Khon Kaen [Phu Khiao, *ca.* 80 km E of

Phetchabun, 11 Jul. 1984, *G. Murata et al.* T-41627 (BKF)]; EASTERN: Nakhon Ratchasima [Huai Thalaeng, 12 Dec. 1928, *Put* 2238 (BK, BM)]; SOUTH-WESTERN: Kanchanaburi [Huai Bankau, 9 Nov. 1971, *C.F. van Beusekom et al.* 3597 (BKF, P)]; PENINSULAR: Phangnga [Khao Phra Mi, 9 Jan. 1966, *B. Hansen & T. T. Smitinand* 11868 (BKF, C, K); Khlong Nang Yon, 28 Apr. 1973, *R. Geeink & T. Santisuk* 5004 (BKF, P)].

Distribution.— China, India, Indo-China.

Ecology.— On sunny slope, edge of dipterocarp forest or in evergreen forest, up to 1,225 m altitude. Flowering in June to February.

Vernacular.— Ya khon (หญ้าขน) (Nakhon Ratchasima).

b. var. pubescens (Hack.) S.M. Phillips & S.L. Chen, Novon 15 (3): 470. 2005.

Rottboellia striata Nees ex Steud. var. *pubescent* Hack. in DC., Monogr. Phan. 6: 302. 1889.— Type: India, Khasia, Meghalaya, *J.D. Hooker & T. Thomson* s.n. (holotype K!, isotype L!).

Coelorachis striata var. *pubescens* (Hack.) Bor, Grasses Burma, Ceyl., India Pak.: 121. 1960.

Perennial grass, caespitose, large stout tufted with propagules below. *Culms* erect, up to 1.5 m tall, terete, internodes glabrous, nodes slightly hairy to pubescent. *Leaf-sheaths* tight, 6.5–15 cm long, glabrous to pilose, if glabrous usually pilose at margins. *Ligules* membranous with ciliate margins. *Leaf-blades* up to 70 by 1–2.5 cm, pilose or pubescent on both surfaces, margins scabrous and pilose, apex acute. *Inflorescence* composed of many racemes, 7–11 cm long, terminal and axillary, subtended by a spatheole, rachis internodes clavate, swollen at the upper part, 3.5–4.5 by 1–1.5 mm, glabrous, nodes glabrous; spikelets in pairs or tripets, callus glabrous. *Sessile spikelets* dorsally compressed. *Glumes*; lower glume ovate, indurate, 4.5–5 *ca.* 1.5 mm, continuous ridge along the length and interrupted by tubercles, or tubercle-based hairs, margins glabrous, apex with 2 apical wings; upper glume boat-shaped, *ca.* 3.5 by 1 mm, keeled on the back, on the upper part, glabrous, apex acute. *Lower floret*; lemma ovate-acuminate, *ca.* 2.8 by 0.8 mm, hyaline, glabrous, slightly folded; palea lanceolate, *ca.* 2 by 0.3 mm, hyaline, muticous. *Upper floret*; lemma lanceolate, *ca.* 2 by 0.3 mm, hyaline, glabrous; palea boat-shaped, *ca.* 2.5 by 0.8 mm, hyaline,

glabrous, apex acute. *Lodicules* cuneate, *ca.* 0.5 mm long. *Anthers* 2–2.5 mm long. *Pedicelled spikelet* oblong, 0.5–2 mm long, reduced into 2 asymmetrical glumes, glumes dissimilar, winged at apex, slightly folded, glabrous. *Pedicels* oblong or ribbon-like, 3.5–4.5 by 0.8–1 mm, with distinct 2 green lines, glabrous, apex concave (Fig. 5.21K-N).

Thailand.— NORTHERN: Mae Hong Son [Huai He, Mueang, 22 Dec. 2005, *P. Traiperm* 349 (BCU, BKF, KKU)], Chiang Mai [Doi Suthep, 11 Nov. 1911, *A.F.G. Kerr* 1601B (BM, E, K); 25 Nov. 1920, *J.F. Rock* 187 (P); 8 Feb. 1958, *Th. Sørensen et al.* 878 (BKF, C); 20 Apr. 1958, *Th. Sørensen et al.* 2923 (C); 27 Sept. 1958, *Th. Sørensen et al.* 5280 (C); 21 Nov. 2005, *P. Traiperm* 295 (BCU, BKF, KKU); Doi Inthanon, 24 Nov. 2005, *P. Traiperm* 306 (BCU, BKF, KKU); Doi Chiang Dao, 22 Sept. 1990, *J.F. Maxwell* 90-1033 (AAU, CMU, L); 10 Oct. 1995, *J.F. Maxwell* 95-881 (BKF, L); Queen Sirikit Botanical Garden, 26 Nov. 2005, *P. Traiperm* 313 (BCU, BKF, KKU), 314 (BCU, BKF, KKU), 315 (BCU, BKF, KKU); Mae Sao, 18 Dec. 2005, *P. Traiperm* 346 (BCU, BKF, KKU); Hill between Thoen & Lee, 29 Nov. 1959, *T. Smitinand & E.C. Abbe* 6168 (K)], Chiang Rai [Doi Tung: en route from Ban Huai Khrai to Wat Doi Tung, 24 Sept. 1967, *K. Iwatsuki et al.* T 10929 (BKF, E)], Lampang [Khun Tan, 4 Dec. 2005, *P. Traiperm* 322 (BCU, BKF, KKU), 324 (BCU, BKF, KKU)], NORTH-EASTERN: Phetchabun [Nam Nao, 20 Nov. 2004, *P. Traiperm* 168 (BCU, BKF, KKU), 169 (BCU, BKF, KKU), 174 (BCU, BKF, KKU); 17 Nov. 2005, *P. Traiperm* 281 (BCU, BKF, KKU); 7 Jan. 2006, *P. Traiperm* 373 (BCU, BKF, KKU); Thung Salaeng Luang, 17 Nov. 2005, *P. Traiperm* 283 (BCU, BKF, KKU), 286 (BCU, BKF, KKU)], Loei [Phu Ruea, 6 Dec. 2004, *P. Traiperm* 198; 23 Apr. 2005, *P. Traiperm* 200 (BCU, BKF, KKU); 15 Nov. 2005, *P. Traiperm* 326 (BCU, BKF, KKU); Phu Kradueng, 31 Oct. 2005, *P. Traiperm* 272 (BCU, BKF, KKU)], Khon Kaen [Khok Phu Taka, 9 Sept. 2004, *P. Traiperm* 126 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [Phu Khiao, 27 Nov. 2004, *P. Traiperm* 184 (BCU, BKF, KKU), 185 (BCU, BKF, KKU); 19 Oct. 2005, *P. Traiperm* 224 (BCU, BKF, KKU), 227 (BCU, BKF, KKU), 228 (BCU, BKF, KKU)]; SOUTH-WESTERN: Kanchanaburi [Sai Yok, 07 Dec. 1961, *K. Larsen* 8581 (C, K)]; PENINSULAR: Phangnga [Khao Phra Mi, 9 Jan. 1966, *B. Hansen & T. Smitinand* 11868 (BKF, K); Khlong Nang Yon, 28 Apr. 1973, *R. Geeink & T. Santisuk* 5004 (BKF, C, E, P)].

Distribution.— China, India and Indo-China.

Ecology.— Grass common in moist localities in mixed deciduous forest, at 100-2,200 m altitude. Flowering in September to April.

Notes.— Newly recorded for the country.

7. Mnesithea thailandica P. Traiperm & T. Boonkerd *sp. nov.* (*ined.)*

Perennial with caespitose. *Culms* erect, slender, 26 cm tall, internodes pilose to pubescent, nodes dense ciliate hairs. *Leaf-sheaths* loose, 2.5–6 cm long, pilose. *Ligules* membranous with ciliate margins, *ca.* 0.5 mm long. *Leaf-blades* 5–20 by 0.4–0.8 mm, pilose on both surfaces, apex acute. *Inflorescence* racemes, *ca.* 6 cm long, terminal, subtended by a spatheole, rachis internodes cupuliform, 2–2.5 mm long, with densely appressed hairs, nodes pubescent; spikelets in pairs, callus pubescent. *Sessile spikelets* dorsally compressed. *Glumes*; lower glume triangular, *ca.* 4 by 2 mm, indurate, margins folded, smooth and densely appressed hairs on the back, apex with 2 narrow wings; upper glume ovate or boat-shaped, *ca.* 3 by 1.3 mm, keeled on the upper and pilose along keel. *Pedicelled spikelet* oblong, *ca.* 1 mm long, reduced into 2 asymmetrical glumes, keeled along the margins, with densely appressed hairs on surface. *Pedicels* oblong or ribbon-like *ca.* 3 by 0.6 mm, with densely appressed hairs (Figs. 5.22 & 5.46A-D).

Thailand.— EASTERN: Roi Et [Suwannaphum, Nayai, Ban Hang Hoei, 10 June 1982, *Y. Paisooksantivathana & S. Sutheesorn* y 1048-82 (BK)].

Distribution.— Endemic to Thailand.

Ecology.— Common in paddy field, at 100 m altitude. Flowering in June.

Note.— *Mnesithea thailandica* is distinguished by the appressed hairs on the inflorescence. It is similar to Malaysian species, *M. geminata* but differs in having a small erect and slender culm, *ca.* 26 cm tall. The species has pubescent hairs on the back of the triangular lower glume, rachis nodes, pedicels and rachis internode, while lanceolate and hirsute below and glabrous on rachis nodes, pedicels and rachis internode in *M. geminata*.

8. Mnesithea sp.1

Perennial grass, caespitose, large stout tufted with propagules below. *Culms* erect, up to 2 m tall, terete, internodes glabrous, nodes glabrous to pubescent. *Leaf-*

sheaths tight, 5–10 cm long, slightly pilose on margins. *Ligules* membranous, *ca.* 2 mm long. *Leaf-blades* 20–80 by 1.5–2.5 cm, glabrous to pilose on both surfaces, margins scabrous and pilose, apex acuminate. *Inflorescence* composed of several racemes, slightly flattened, 6–8 cm long, terminal and axillary, subtended by a spatheole, rachis internodes oblong, flattened but swollen at the tip or the upper part, 5–6.5 by 1.2–1.5 mm, 7–10-nerved, glabrous, nodes glabrous; spikelets in pairs alternating rows, callus glabrous. *Sessile spikelets* dorsally compressed. *Glumes*; lower glume oblong, indurate, 5–5.5 by 1.2–1.5 mm, 7–8-nerved, 7–8 longitudinal rows of small pits between the nerves, glabrous on the back, margins at base puberulous, folded, unequal winged at apex; upper glume boat-shaped, *ca.* 5 by 1 mm, keeled on the back, along the midnerve, margins slightly folded, glabrous, apex acute. *Lower floret*; lemma ovate-acute, *ca.* 4.8 by 1.5 mm, hyaline, glabrous, slightly folded; palea ovate-acute, *ca.* 2 by 0.8 mm, hyaline. *Upper floret*; lemma ovate, *ca.* 3.5 by 0.8 mm, hyaline; palea boat-shaped, *ca.* 4.5 by 1 mm, hyaline. *Lodicules* cuneate, 0.5 mm long. *Anthers* 2–2.5 mm long. *Pedicelled spikelet* oblong-ovate, 1.8–2.5 mm long, reduced into 2 asymmetrical glumes, glumes dissimilar, narrowly winged along margins, folded, glabrous. *Pedicels* oblong or ribbon-like, 4.5–5 by 0.8–1.2 mm, with distinct 2–6 green lines, glabrous, apex truncate, pedicels fused to the internodes at the lower part (Figs. 5.23 & 5.46E-G).

Thailand.— NORTHERN: Mae Hong Son [Pai, 20 Dec. 2005, *P. Traiperm* 372 (BCU, BKF, KKU)], Chiang Mai [Doi Suthep, 11 Dec. 1957, *T. Smitinand* 3973 (BKF, K); Doi Inthanon, Sia Leung water falls, 17 Feb. 1979, *T. Koyama et al.* T-15,423 (AAU, BKF); 28 Feb. 1979, *T. Koyama et al.* T-15,586 (AAU); along trail above park wardens house, Chiang Doi Hills, 28 Sept. 2001, *S. Laegaard & M. Norsaengsri* 21641 (AAU); Doi Chiang Dao, 3 Dec. 1984, *W.N.* 1068 (AAU); 28 Nov. 2005, *P. Traiperm* 316 (BCU, BKF, KKU); Pha Hom Pok, 18 Dec. 2005, *P. Traiperm* 347, 19 Dec. 2005, *P. Traiperm* 348 (BCU, BKF, KKU); Wang Tao, 13 Feb. 1958, *Th. Sørensen et al.* 1080 (C, E, K); Doi Suthep, 27 Sept. 1990, *J.F. Maxwell* 90-1063 (CMU, L); on trail from Khun Wang highland, Mae John Luang, 11 Jan. 1986, *Y. Paisooksantivatthana* y 1748-86 (BK)]; SOUTH-WESTERN: Kanchanaburi [Huai Bankau, 9 Nov. 1971, *C.F. van Beusekom et al.* 3597 (BKF, C, P)].

Distribution.— Endemic to Thailand.

Ecology.— Common in Oak pine forest, roadsides, small ravine extending out from hillside. Grass 1-2 m. tall, along edge of small dried-up stream, at altitude 600-1,800 m altitude. Flowering between June and March.

Note.— Most materials of *M.* sp.1 in Thailand were identified as *M. striata.* This species is different from *M. striata* by having oblong lower glume of the sessile spikelet, indurate, 5–5.5 by 1.2–1.5 mm, apex with unequal wings, 7–8 longitudinal rows of small pits between the nerves of the back, margins at base puberulous, while ovate lower glume of the sessile spikelet, indurate, 4.5–5 by *ca.* 1.5 mm, apex with 2 apical wings, continuous ridge along the length and interrupted by tubercles or tubercle-based hairs on the back or glabrous in *M. striata*. It is very clear that I found the two taxa in their same locality.

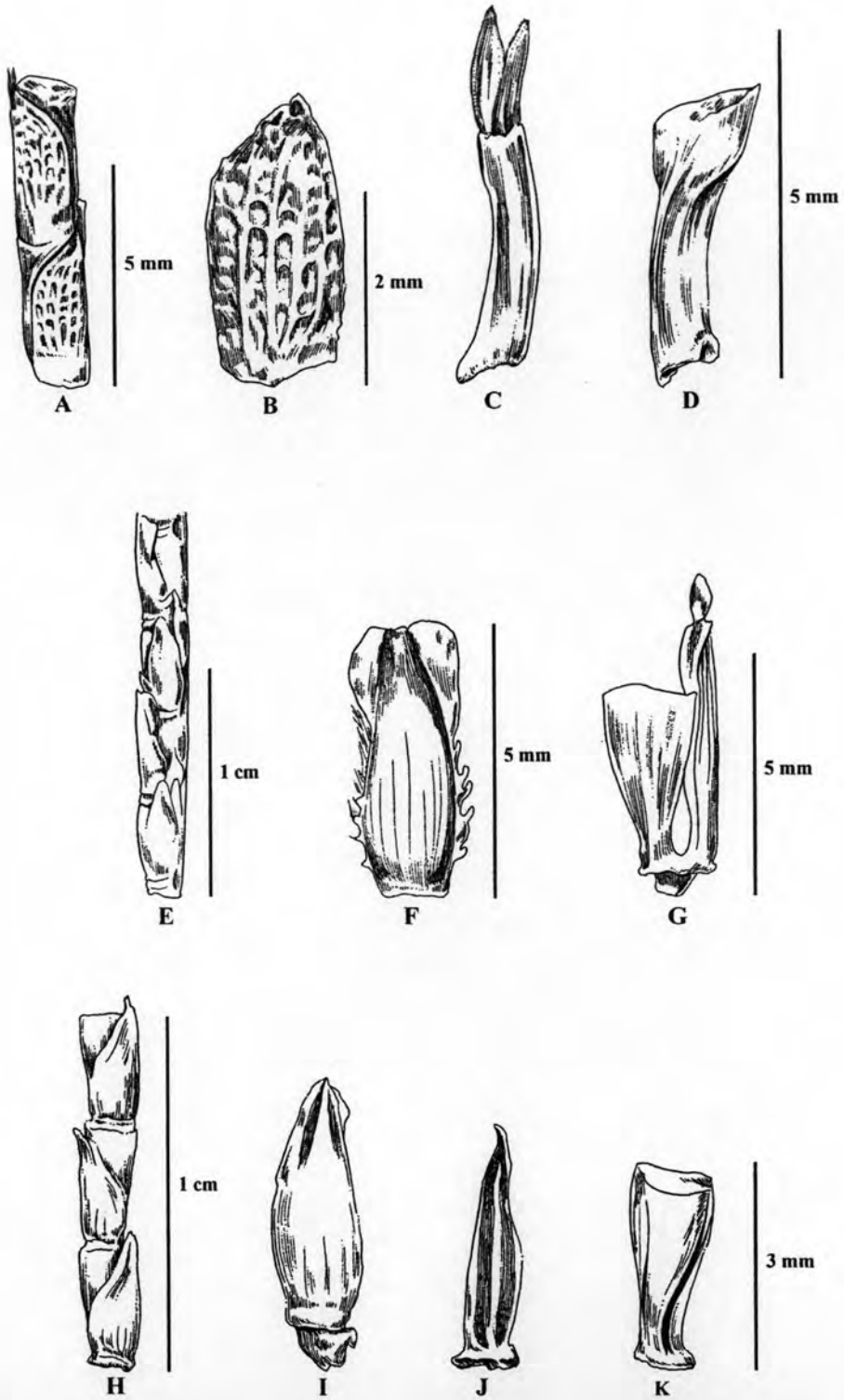

Figure 5.19 A-D. *Mnesithea cancellata*: A. partial raceme; B. lower glume of the sessile spikelet; C. pedicelled spikelet; D. rachis joint. E-G. *M. glandulosa*: E. partial raceme; F. lower glume of the sessile spikelet; G. rachis joint with pedicelled spikelet. H-K. *M. helferi*: H. partial raceme; I. lower glume of the sessile spikelet; J. pedicelled spikelet; K. rachis joint.

Figure 5.20 *Mnesithea laevis*: A. plant; B. partial raceme; C. spikelet pair; D. lower glume of the sessile spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 307.

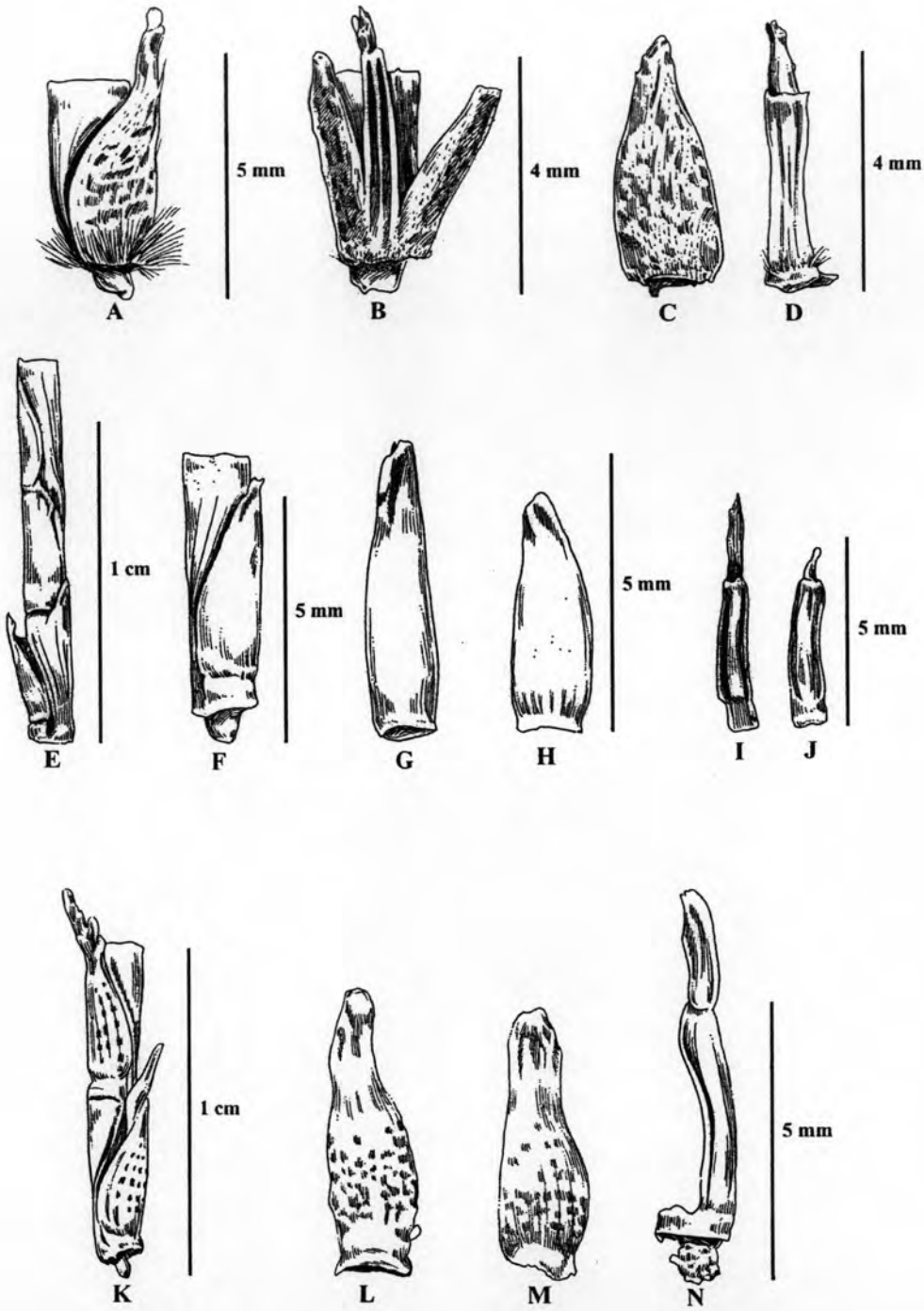

Figure 5.21 A-D. *Mnesithea mollicoma*: A. two views of rachis joint with sessile and pedicelled spikelet; B. three of spikelets; C. lower glume of the sessile spikelet; D. pedicelled spikelet. E-J. *M. striata*: E. partial raceme; F. rachis joint with sessile and pedicelled spikelet; G. & H. lower glume of the sessile spikelet; I. & J. pedicelled spikelet with rachis joint. K-N. *M. striata* var. *pubescens*: K. partial raceme; L. & M. lower glume of the sessile spikelet; N. pedicelled spikelet.

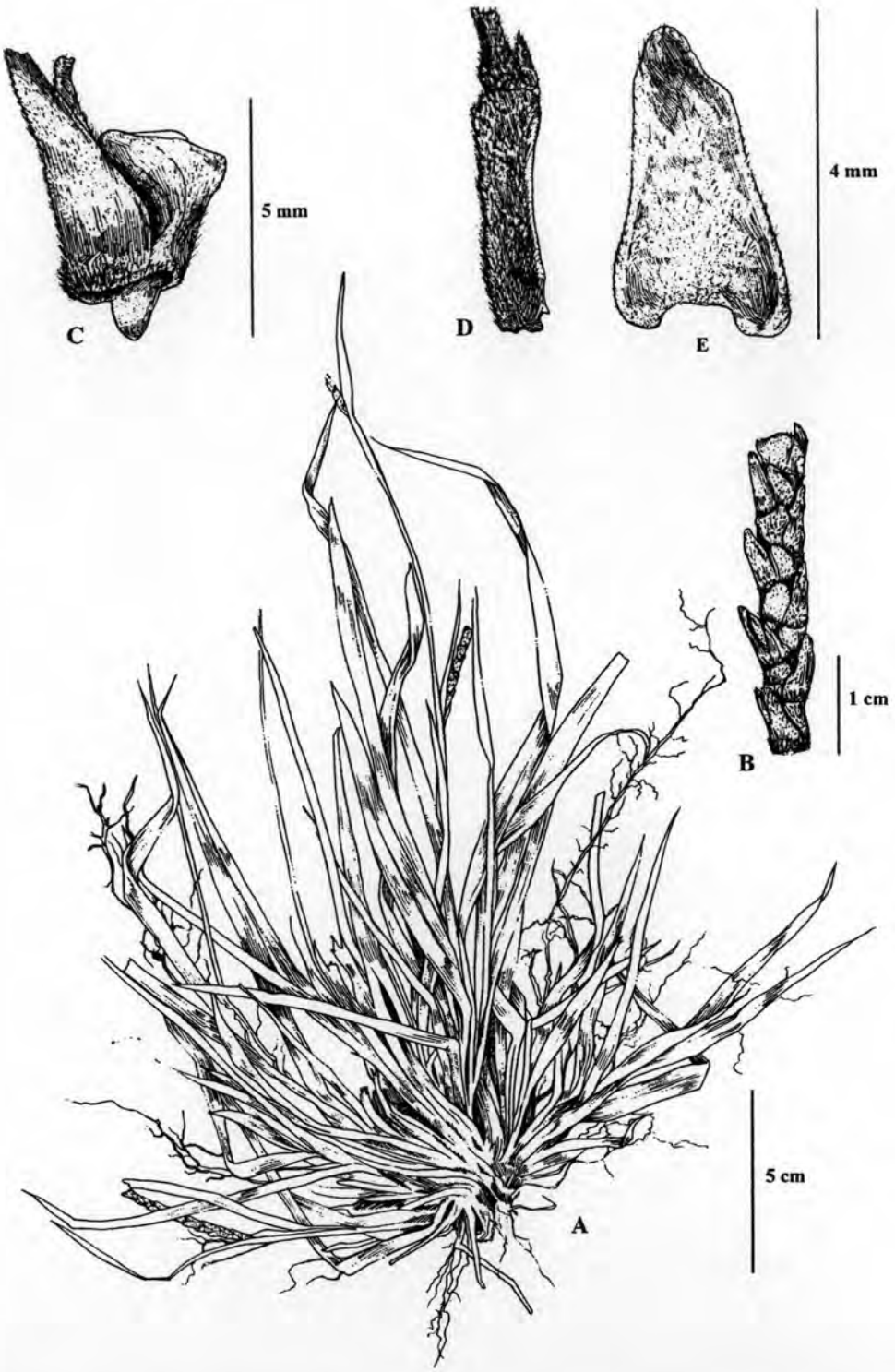

Figure 5.22 *Mnesithea thailandica*: A. plant; B. partial raceme; C. rachis joint with sessile and pedicelled spikelet; D. lower glume of the sessile spikelet; E. pedicelled spikelet with pedicel. All line drawings were drawn by P. Traiperm from the type specimen.

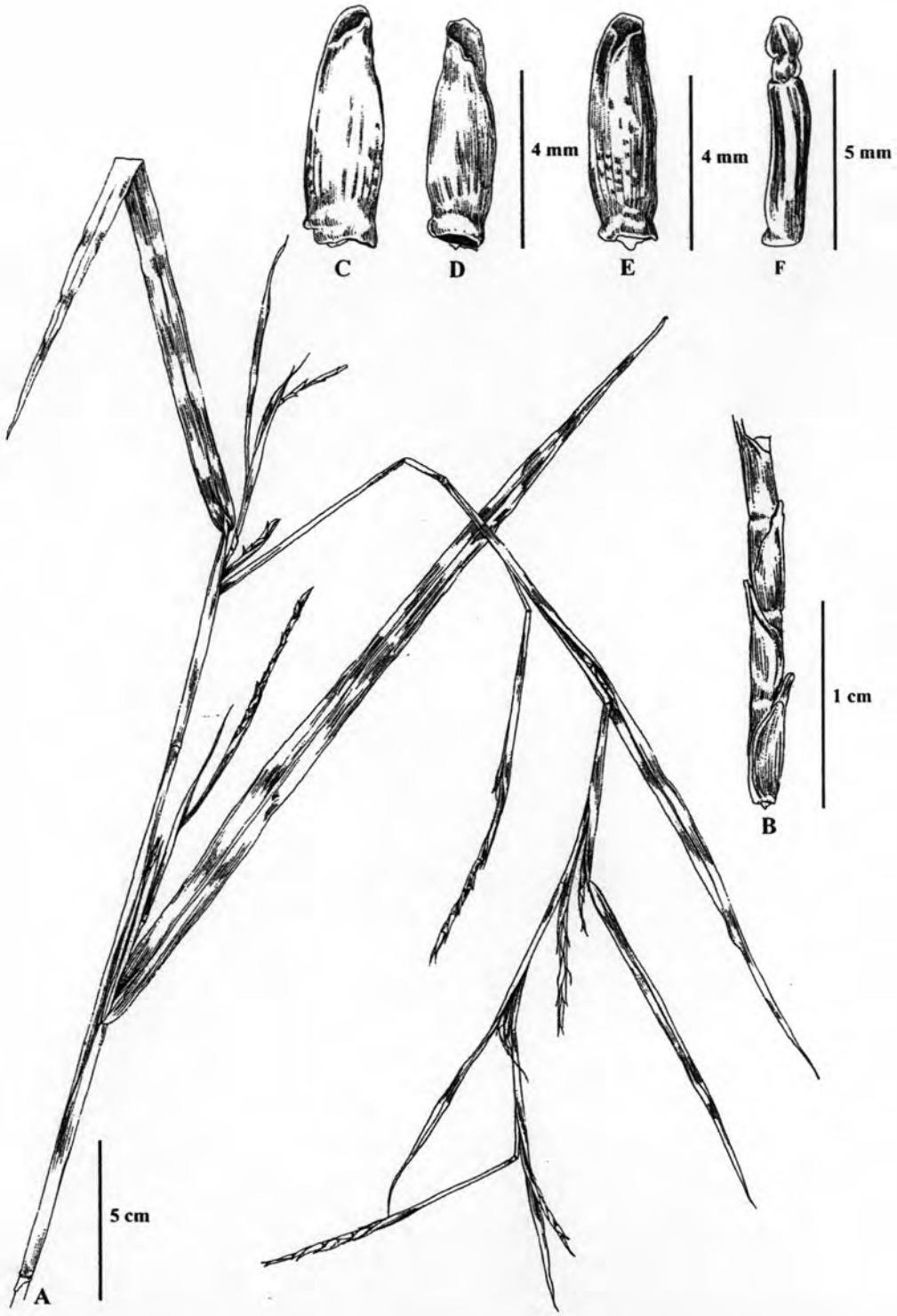

Figure 5.23 *Mnesithea* sp.1: A. plant; B. partial raceme; C-E. lower glume of the sessile spikelet; F. pedicelled spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 347.

5. OPHIUROS

Gaertn., Fruct. 3: 3. 1805.— Type species: *O. corymbosa* (L. f.) Gaertn. (= *O. exaltatus*).

Perennial caespitose. *Culms* erect, robust. *Leaf-sheath* tight. *Ligules* membranous. *Leaf-blade* lanceolate, chartaceous. *Inflorescence* composed of 1 to several racemes, racemes cylindrical, spikelets arranged in two opposite rows, rachis fragile, borne alternately on opposite sides of the rachis. *Sessile spikelets* dorsally compressed, sunken in the hollow of rachis internode. *Glumes*; lower glume oblong, coriaceous, slightly pitted on the back along the length of nerved; upper glume elliptic, boat-shaped, hyaline. *Upper florets* fertile. *Lodicules* cuneate. *Ovary* elliptic. *Lower floret* sterile; lemma ovate, hyaline; paleas lanceolate, hyaline, enfolded. *Pedicelled spikelet* absent. Pedicels fused to internode, united wholly.

A genus of 4 species in the tropical Africa to southern China and Australia; only 1 species occurs in Thailand.

1. Ophiuros exaltatus (L.) O. Kuntze. in Revis. Gen. Pl.: 780. 1891.

Aegilops exaltata L., Mant. 2. App.: 575. 1771.— Type: India, Malabar, *Koenig* s.n. (not seen).

Perennial grass, caespitose. *Culms* erect, robust, 100–200 cm long, terete, glabrous. *Leaf-sheath* tight, 4–10 cm long, glabrescent, margins pilose. *Ligules* membranous, *ca.* 1 mm long. *Leaf-blade* lanceolate, 15–40 by 1–1.5 cm, chartaceous, glabrous or glabrescent on both surfaces, margins pilose with tubercle-based hairs, base round, apex acute. *Inflorescence* composed of 1 to several racemes, rachis internode oblong, 3–4 mm long, excavated. *Sessile spikelets* dorsally compressed, 3.5–4 mm long, sunken in the hollow of rachis internode. *Glumes*; lower glume oblong, 3.5–4 by *ca.* 1 mm, 4–6-nerved, coriaceous, slightly pitted or distinct on the back along the length of nervea, apex acute; upper glume elliptic, boat-shaped, *ca.* 3 by 1 mm, 3–nerved, hyaline. *Upper florets* fertile; lemma elliptic, *ca.* 2.8 by 1 mm, hyaline, enfolded, apex acute; palea lanceolate, *ca.* 2.5 by 0.7 mm, hyaline. *Lodicules* cuneate, *ca.* 0.5 mm long. *Ovary* elliptic, *ca.* 0.4 mm long. *Lower floret* sterile; lemma ovate, *ca.* 2.8 by 1 mm long, hyaline, margins slightly enfolded; palea lanceolate, *ca.*

2.8 by 0.7 mm long, hyaline, enfolded. *Pedicelled spikelet* absent. Pedicels fused to internode, united wholly (Figs. 5.24 & 5.47A-C).

Thailand.— NORTH-EASTERN: Phetchabun [Nam Nao National Park, 20 Nov. 2004, *P. Traiperm* 176 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [Tungkamang, 15 Dec. 1971, *C.F. van Beusekom et al.* 4290 (C, K, L, P); 27 Nov. 2004, *P. Traiperm* 186 (BCU, BKF, KKU)]; CENTRAL: Saraburi [Ban Nang Bua, Za Kao Pat, 4 Oct. 1927, *Put* 1150 (BK, BM, K)].

Distribution.— China, India, Indo-China, Malesia, Australia.

Ecology.— Growing in moist savannah on clayey soil, at 800-2,200 m altitude. Flowering between October and December.

Vernacular.— Ya khao phot phi (หญ้าข้าวโพดผี) (Saraburi).

Notes.— *Put* 1150 and *C.F. van Beusekom et al.* 4290 with a deeply pitted or distinct on the back along the length of nerves in lower glume of sessile spikelet.

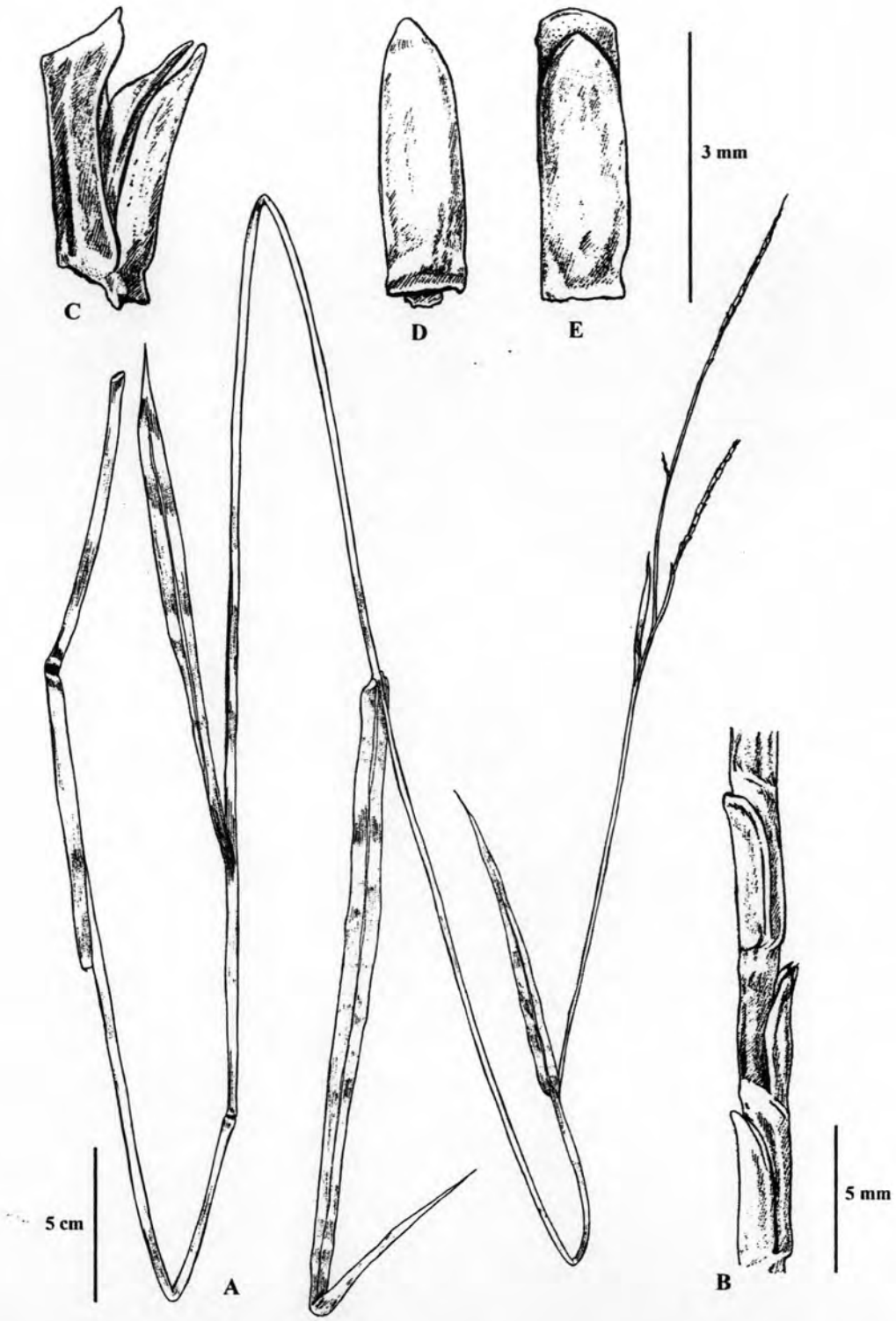

Figure 5.24 *Ophiuros exaltatus*: A. plant; B. partial raceme; C. spikelet pairs; D. lower glume of the sessile spikelet; E. joint. All line drawings were drawn by P. Traiperm from *P. Traiperm* 176.

6. PHACELURUS

Griseb., Fl. Rumel. Bithyn. 2: 423. 1846; Clayton, Kew Bull. 33: 176. 1978.— Type species: *P. digitatus* (Sibth. & Sm.) Griseb.

Jardinea Steud., Syn. Pl. Glum. 1: 360. 1854.— Type species: *J. gabonensis* Steud.

Thyrsia Stapf in Fl. Trop. Afr. 9: 48. 1917.— Type species: *T. inflate* Stapf

Pseudovossia A. Camus, Bull. Mus. Hist. Nat. Paris 26: 665. 1920.— Type species: *P. cambogiensis* (Balansa) A. Camus

Pseudophacelurus A. Camus, Bull. Mus. Hist. Nat. Paris 27: 370. 1921.— Type species: *P. speciosus* (Steud.) A. Camus

Perennial tufted. *Culms* erect. *Leaf-sheaths* loose. *Ligules* ciliate or ciliolate. *Leaf-blades* chartaceous, midnerve distinct. *Inflorescence* composed of several racemes, terminal. *Sessile spikelets* dorsally compressed. *Glumes*; lower glume, coriaceous, winged or caudate at apex; upper glume chartaceous or coriaceous, ovate, lanceolate or boat-shaped. *Lower floret* male or barren. *Upper floret* perfect. *Pedicelled spikelet* similar but smaller than the sessile spikelets. *Pedicel* free. *Lodicule* cuneate. *Ovary* ellipsoid.

A genus of 8 species in the tropics and subtropics of the Old World; 2 species occur in Thailand.

KEY TO THE SPECIES

1. Raceme solitary, the spikelets spreading, lower glume of the sessile spikelets lanceolate, 16–17 by *ca.* 1.5 mm **1. P. cambogiensis**
1. Raceme borne on along central axis, lower glume of the sessile spikelets oblong or narrowly ovate, 3–3.5 by 1–1.2 mm **2. P. zea**

1. Phacelurus cambogiensis (Balansa) Clayton, Kew Bull. 33 (2): 177. 1978.

Vossia cambogiensis Balansa, Journ. Bot. (Morot) 4: 109. 1890.— Type: Cambodia, Toule-sap, *Godefroy* 129 (holotype L!, isotype K!).

Pseudovossia cambogiensis (Balansa) A. Camus, Bull. Mus. Hist. Nat. Paris 26: 665. 1920.

Perennial, tufted. *Culms* erect, *ca.* 45 cm tall, slender, terete, internodes glabrous, nodes glabrous or slightly hairy. *Leaf-sheaths* loose, glabrous. *Ligules* ciliate. *Leaf-blades* 30–50 by 0.5–0.7 cm, chartaceous, glabrous or glabrescent on both surfaces, margins scabrous, midnerve distinct. *Inflorescence* composed of racemes, raceme solitary, the spikelets spreading, up to 20 cm long, rachis internodes and nodes glabrous. *Sessile spikelets*. *Glumes*; lower glume lanceolate, 16–17 by *ca.* 1.5 mm, coriaceous, glabrous on the back, scabrous wing on keel, tapering to apex, caudate; upper glume lanceolate-acumonate, 11–12 by *ca.* 1 mm, coriaceous, glabrous on the back, scabrous wing on keel. *Lower floret* male, lemma linear, 9–10 by *ca.* 1 mm, hyaline, folded upper margins scabrous; palea lanceolate-acute, 7–7.5 by *ca.* 0.8 mm, hyaline, slightly folded. *Lodicules ca.* 1.5 mm long. *Anthers ca.* 2 mm long. *Upper floret*; lemma linear, *ca.* 8 by 0.8 mm, hyaline, folded; palea linear, *ca.* 7 by 0.8 mm, hyaline, folded. *Ovary ca.* 1.5 mm long. *Pedicelled spikelet* usually resembling the sessile spikelet. *Pedicels* oblong, flattened. *Glumes*; lower glume linear-obtuse, 22–23 by *ca.* 1.5 mm, obliquely plicate, coriaceous, scabrous wing on keel, glabrous on the back, apex caudate; upper glume lanceolate, 10–11 by *ca.* 1.3 mm, coriaceous, plicate, scabrous wing on keel on the back. *Lower floret*; lemma lanceolate, plicate, 8–9 by *ca.* 1 mm, hyaline, folded, upper margins ciliate; palea linear-obtuse, 7–8 by *ca.* 0.8 mm, hyaline, folded. *Anthers ca.* 2 mm long. *Upper floret*; lemma lanceolate-acuminate, 7–7.5 by *ca.* 1 mm, hyaline, folded upper margins scabrous; palea linear, 6.5–7 mm long, hyaline, folded (Fig. 5.47D-F).

Thailand.— NORTH-EASTERN: Nakhon Ratchasima [Phimai, Sai Ngam, 26 Aug. 1958, *T. Smitinand* 4781 (K); Phimai, 27 Dec. 1958, *T. Smitinand* 5046 (BK, K)].

Distribution.— Cambodia.

Ecology.— Tufted grass, common along edge of swampy, at 200-250 m altitude. Flowering between August and December.

Notes.— *P. cambogiensis* was recorded only two times from Thailand. I can not be collected even their original localities.

2. Phacelurus zea (C.B. Clarke) Clayton, Kew Bull. 33 (2): 177. 1978.

Rottboellia zea C.B. Clarke, J. Linn. Soc., Bot. 25: 86, t. 35. 1889.— Type: India, Muneypore, *C.B. Clarke* 41980 (holotype K!).

R. thyrsoidea Hack. in DC., Monogr. Phan. 6: 283. 1889.— Type: India, Khasia, *J.D. Hooker & T. Thomson* s.n. (isotypes K!, L!).

Thyrsia thyrsoidea (Hack.) A. Camus in Bull. Mus. Hist. Nat. Paris 27: 369. 1921.

T. zea (C.B. Clarke) Stapf in Hook., Ic. Pl. 31: t. 3078. 1922.

Perennial grass, tufted, large stout plant. *Culms* erect, up to 2.5 m tall, terete, internodes glabrous, nodes ciliate. *Leaf-sheaths* loose, 15–30 cm long, glabrous, margins with white pilose hairs. *Ligules* ciliolate. *Leaf-blades* oblong-lanceolate, 30–150 by 1–1.5 cm, chartaceous, adaxial suface scabrous and slightly long hairy sometimes short hairs, abaxial surface glabrous, midnerve distinct, margins scabrous and slightly pilose, apex acuminate. *Inflorescence* compound racemose, terminal, composed of numerous racemes (25–45), borne along a central axis, central inflorescent axis up to 50 cm long, rachis semi-terete, glabrous, rachis internodes cuneate, 3–8 mm long, glabrous. *Sessile spikelets* ovate, dorsally compressed, 3–4 mm long, callus truncate. *Glumes*; lower glume oblong or narrowly ovate, 3–3.5 by 1–1.2 mm, coriaceous, muticous keeled and narrowly winged all along the margins, scabrous; upper glume ovate, boat-shaped, 3–3.5 by *ca.* 1 mm, 3-nerved, chartaceous, keeled along the back and scabrous, apex acute. *Lower floret* male or barren; lemma narrowly ovate, 3–3.2 by *ca.* 1 mm, 3-nerved, hyaline, margins enfolded; palea absent. *Upper floret* perfect; lemma ovate, boat-shaped, *ca.* 3 by 1 mm, hyaline, keeled along the back; palea lanceolate, *ca.* 2 by 0.5 mm, hyaline, margins enfolded. *Pedicelled spikelet* usually resembling but smaller than the sessile spikelet. *Pedicels* linear, flattened, 1–2 mm long. *Glumes*; lower glume oblong-ovate, 3–3.5 by *ca.* 0.1 mm, coriaceous, with scabrous wing along the margins, apex acute; upper glume boat-shaped, *ca.* 3 by 1 mm, subcoriaceous, with scabrous wing on keeled on the back, apex acute. *Lower floret*; lemma oblong-ovate, *ca.* 3 by 0.8 mm, 3-nerved, hyaline, apex acute, folded; palea absent. *Upper floret*; lemma oblong-ovate, 2.5–3 by *ca.* 0.8 mm, hyaline, folded; palea ovate, 2–2.5 by *ca.* 0.8 mm, hyaline, folded, apex acute. *Caryopsis* ellipsoid, *ca.* 1.5 mm long (Fig. 5.48A-D).

Thailand.— NORTH-EASTERN: Phetchabun [Pine Grove, 1 Jun. 1960, *T. Smitinand* 6307 (BKF); Tung Salaeng Luang Nat. Park 17 Nov. 2005, *P. Traiperm* 282 (BCU, BKF, KKU)]; EASTERN: Chaiyaphum [Tungkamang, 14 Dec. 1971, *C.F. van Beusekom et al.* 4267 (K, L, P), 19 Oct. 2005, *P. Traiperm* 222 (BCU, BKF, KKU)].

Distribution.— India, Indo-China.

Ecology.— Tufted grass, common in oak and pine forest on clayey soil, at altitude 800-900 m. Flowering between June and December.

Notes.— *Phacelurus zea* is easily recognised from *P. cambogiensis* by a robust plant with a compound racemes inflorescence on terminal, which composed of numerous racemes (25–45) borne along a central axis.

7. ROTTBOELLIA

L. f., Nov. Gram. Gen.: 23. 1779. & Suppl. Pl.: 114. 1781. *nom. cons. non* Scop. 1777.— Type species: *R. exaltata* L. f. (= *R. cochinchinensis*).

Stegosia Lour., Fl. Cochin.: 51. 1790.— Type species: *S. cochinchinensis* Lour.

Robynsiochloa Jac.-Fél. in J. Agric. Trop. 7: 406. 1960.— Type species: *R. purpurascens* (Robyns) Jac.-Fél.

Annual tufted. *Culms* erect. *Leaf-sheaths* tight, hirsute. *Ligules* membranous with ciliolate margins. *Leaf-blades* linear-lanceolate or broadly linear. *Inflorescence* racemes, terminal and axillary. *Sessile spikelets* fertile and sunk in concavities on lateral internodes of rachis. *Glumes*; lower glume ovate, coriaceous, smooth, 2-toothed; upper glume boat-shaped, subcoriaceous. *Lower floret* staminate. *Upper floret* perfect. *Pedicelled spikelet* staminate or neutral, reduced and compressed. *Pedicel* wholly fuse to the internodes.

A genus of 4 species in the Old World tropics and introduced to the Caribbean; 1 species occurs in Thailand.

1. Rottboellia cochinchinensis (Lour.) Clayton, Kew Bull. 35 (4): 817. 1981.

Stegosia cochinchinensis Lour., Fl. Cochich. 1: 51. 1790.— Type: Cochinchina, (holotype BM!, isotypes K!; L!).

R. exaltata L. f., Suppl. Pl.: 114. 1781, non (L.) L. f., Nov. Gram. Gen.: 23: 37. 1779.— Type: In Indiis, *Thunberg* (holotype LINN!).

Ophiuros appendiculatus Steud.— Type: Javanica, *Zollingero* 7257 (holotype P!, isotype L!).

Annual grass. *Culms* erect, 0.7–2 m tall, terete, internodes solid, supported below by stilt roots, hirsute. *Leaf-sheaths* tight, terete, usually more hirsute, margins open. *Ligules* membranous with ciliolate hairs, brown. *Leaf-blades* linear-lanceolate or broadly linear, up to 45 by 1–2 cm, scabrous with minute stiff hairs above, very rough along margins, apex tapering to a long fine point. *Inflorescence* racemes, terminal and axillary, 1–4 racemes together, several inflorescences per culm, 8–15 by 0.2–0.3 cm. *Sessile spikelets* fertile and sunk in concavities on lateral internodes of rachis. *Glumes*; lower glume ovate, 4.5–5 by *ca.* 2 mm, 9–11-nerved, coriaceous, smooth or very slightly rough on the back, subacute at apex, entire or very minutely 2-toothed; upper glume boat-shaped, 9–12-nerved, subcoriaceous, apex acute. *Lower floret* staminate; lemma boat-shaped, 3-4 by 1.4–1.5 mm, 3-nerved, membranous, apex acute; palea ovate, 4–4.5 by 1.6–1.7 mm, 2-nerved, membranous acute. *Lodicules* conical, 4–5 mm long, entire marginal. *Anthers ca.* 2 mm long, brown. *Upper floret* perfect; lemma boat-shaped, obliquely ovate, 3–3.5 by 3.5–4 mm, 3-nerved, chartaceous; palea hastate, 2.5–3 mm long, 2-nerved, membranous. *Anthers* 2.3–3 mm long, purple or brown. *Ovary* elliptic, 1–1.5 mm long. *Stigmas* purple. *Pedicelled spikelet* staminate or neutral, reduced and compressed, 3.5–4 mm long. *Pedicels* wholly fused to the internodes, flattened (Figs. 5.25 & 5.48E-G).

Thailand.— NORTHERN: Mae Hong Son [Pai, Ban Tah By, near by river, Tung Yo, 12 Sept. 1992, *J.F. Maxwell* 92-535 (AAU, E, L, P)], Chiang Mai [Hahng Dong, Huai Din Dam, Nam Prae, 29 Aug. 1987, *J.F. Maxwell* 87-913 (CMU, L); Chom Thong, Mae Soi Valley, 6 Sept. 1992, *J.F. Maxwell* 92-513 (P); Doi Saket, Huai Hong Khrai Royal Development Project, 8 Nov. 1993, *S. Suwannaratana* 35 (L); Doi Suthep, 11 Aug. 1996, *BGO. Staff* 7051 (QBG); Sangampaeng, Doi Mueang Awn, W side, Sahagawn, Mae Awn, 15 Sept. 1998, *P. Palee* 399 (L); above Training Center of Queen Sirikit Botanical Garden, 5 Oct. 2001, *S. Laegaard* 21676 (AAU)], Lampang [Wahng Nua, Doi Luang National Park, near Wahng Gayo Falls, Ban Hang, 22 Apr. 1997, *J.F. Maxwell* 97-383 (BKF, L)], Tak [Bhumipol Dam, *Bunnak* 533

(BK); Tha Ki Lek, 19 Nov. 1961, *K. Larsen* 8327 (C); Hat Palom, 20 Dec. 1961, *K. Larsen* 8855 (C, K); along Huai Mae Lamao, *ca.* 60 km W of Tak, 23 Jul. 1973, *G. Murata et al.* T-16831 (BKF, L, P)]; NORTH-EASTERN: Loei [Phu Kradueng, 16 Dec. 1954, *T. Smitinand* 2114 (BKF, K); 25 Aug. 1994, *BGO. Staff* s.n. (QBG); Phu Luang National Park, 14 Oct. 2000, *M. Norsangsri* 1087 (QBG)], Sakon Nakhon [23 Oct. 1931, *A.F.G. Kerr* 20565 (BK, BM, K); Phu Phan, 12 May 1958, *Ploenchit* 2015 (BKF)], Khon Kaen [Phu Khiao, *ca.* 80 km E of Phetchabun, 11 Aug. 1984, *G. Murata et al.* T-41776 (BKF); Mueang, 31 Jul. 2004, *P. Traiperm* 115 (BCU, BKF, KKU); 6 Oct. 2004, *P. Traiperm* 128 (BCU, BKF, KKU); Mancha Khiri, 24 Aug. 2005, *P. Traiperm* 208 (BCU, BKF, KKU)]; EASTERN: Nakhon Ratchasima [Pak Chong, 9 May 1958, *T. Smitinand* 4860 (BKF)]; SOUTH-WESTERN: Uthai Thani [Thum Prayarpaishu, 7 Sept. 1975, *S. Sutheesorn* 3429 (BK)], Kanchanaburi [Sai Yok, 40 Jul. 1963, *K. Larsen* 10504 (C, K); Si Sawat, 12 Aug. 1970, *C.P. et al.* 2916 (AAU, K, L)], Prachuap Khiri Khan [Cha-um, 15 Apr. 1960, *C. Chermsirivathana* s.n. (BK); Khao Sam Roi Yot, Kui Buri, 25 Oct. 1973, *S. Sutheesorn* 2698b (BK); Bang Sapan Noi, 24 Aug. 1996, *BGO. Staff* 210 (QBG)]; CENTRAL: Chai Nat [Mae Klang, 12 Apr. 1953, *K. Suvathabhandhu* 387 (BK)], Lop Buri; [Dong Pa Ya Yen, Chai Badan, 15 Dec. 1923, *A.F.G. Kerr* s.n. (BM); along road, S of Lop Buri, 23 Sept. 1971, *G. Murata et al.* 14818 (BKF, P); along route 21, *ca.* 9 km N from the junction of route 1 and 21, 20 Oct. 1984, *G. Murata et al.* T-38219 (BKF); Bencha Khiri temple, Phathana Nikhom, 30 Aug. 2001, *R. Pooma et al.* 2998 (BKF, L)], Suphan Buri [Uthong, 15 Apr. 2004, *P. Traiperm* 193 (BCU, BKF, KKU)], Saraburi [Muak Lek, Waste-land, 10 Feb. 1963, *T. Smitinand & H. Sleumer* s.n. (BKF); Khao Talu, Na Pra Larn, 6 Oct. 1979, *T. Shimizu et al.* T-18014 (AAU, BKF, L); 29 Sept. 1991, *K. Larsen et al.* 42100 (AAU)], Krung Thep Maha Nakhon [20 Jun. 1920, *A.F.G. Kerr* 4283 (BM, K, TCD); 28 Sept. 1923, *A.F.G. Kerr* 7854 (BK, BM, K, TCD); Bang Khen, 10 Sept. 1958, *T. Smitinand* 5400 (BKF); Bang Ka Pi, 26 Jul. 2004, *P. Traiperm* 114 (BCU, BKF, KKU)], Samut Prakan [Bahng Grah Jow Temple, Phra pradaeng, 8 Aug. 1971, *J.F. Maxwell* 71-471 (AAU, L)]; SOUTH-EASTERN: Prachin Buri [Krabin Buri, 5 Sept. 2004, *P. Traiperm* 194 (BCU, BKF, KKU)], Chon Buri [Si Racha, 9 Dec. 1927, *D.J. Collins* 1911 (BK, K); Sattahip, 2 Nov. 2004, *P. Traiperm* 151 (BCU, BKF, KKU)], Chanthaburi [Pong Nam Ron, Wang Kaphae, 10 Aug. 1956, *T. Smitinand* 3545 (BKF)]; PENINSULAR: Songkhla [Mueang, 18 Oct. 2004, *P. Traiperm* 133 (BCU, BKF, KKU)].

Distribution.— Worldwide.

Ecology.— Weed on roadsides in open area, at sea level up to 1,300 m altitude. Flowering throughtout the year.

Vernacular.— Ya ko (หญ้ากอ) (Trat); Ya khayong (หญ้าโขย่ง) (Krung Thep Maha Nakhon); Ya prong khai (หญ้าโปร่งคาย) (Lampang); Itchgrass, Corngrass.

Notes.—*Rottboellia cochinchinensis* is readily distinguished from others genus in subtribe Rottboelliinae by the internodes of the inflorescence are corky. This species is variable in size and likely to spread further as it is one of the world's worst weed.

Figure 5.25 *Rottboellia cochinchinensis*: A. plant; B. & C. spikelet pairs (two views); D. & E. lower glume of the sessile spikelet; F. lower glume of the pedicelled spikelet; G. upper glume of the pedicelled spikelet. All line drawings were drawn by P. Traiperm from *P. Traiperm* 133.

8. VOSSIA

Wall. & Griff., J. As. Soc. Bengal. Nat. Hist. 5: 572. 1836. *nom. cons. non* Adanson 1763.— Type species: *V. procera* Wall. & Griff. (*V. cuspidata*).

Perennial caespitose. *Culms* erect. *Leaf-sheaths* tights. *Ligules* membranous with ciliate margins. *Leaf-blades* with midnerve distinct and hook along midnerve or sometimes without, scabrous along margins. *Inflorescence* digitate racemes, terminal. *Sessile spikelets* dorsally compressed. *Glumes*; lower glume, coriaceous, with long caudate apex; upper glume oblong or boat-shaped. *Lower floret*; lemma oblong-acute; palea oblong-acute. *Upper floret*; lemma oblong-acute; palea oblong-acute. *Pedicelled spikelet* similar to but smaller than the sessile spikelets. *Pedicel* free. *Lodicule* cuneate. *Ovary* ellipsoid.

A genus of only 1 species in Tropical Africa and India and also occurs in Thailand. Typically found in semi-aquatic habitats.

1. Vossia cuspidata (Roxb.) Griff., Ic. Pl. Asiat. t. 153. 1851.

Ischaemum cuspidatum Roxb., Fl. Brit. Ind. 1: 325. 1820.— Type: Bengal (not seen).

V. procera Wall. & Griff., J. As. Soc. Beng. 5: 573. 1836.— Type: India Bengalae orientalis, Barak (not seen).

Perennial grass, caespitose. *Culms* erect, up to 2 m tall, internodes terete, glabrous, nodes glabrous. *Leaf-sheaths* tight, glabrous. *Ligules* membranous with ciliate margins. *Leaf-blades*; adaxial surface pilose, abaxial surface glabrous, midnerve distinct and hooked along midnerve or sometimes without, scabrous along margins. *Inflorescence* composed of racemes, racemes 1–3: single, or paired, or digitate, *ca.* 15 cm long, terminal, rachis internodes clavate, flattened, *ca.* 1 cm long, scabrous along keel, nodes glabrous or slightly scabrous. *Sessile spikelets* dorsally compressed. *Glumes*; lower glume oblong-ovate, indurate, 2.3–2.5 cm by *ca.* 3.5 mm, coriaceous, glabrous on the back but scabrous along margins, with long caudate apex; upper glume oblong or boat-shaped, 10.5–11 by *ca.* 3.0 mm, 3-nerved, keeled along the upper part on the back and scabrous along keel, apex acute. *Lower floret*; lemma

oblong-acute, 9–9.5 by 1.8–2 mm, hyaline, glabrous but hairy along margins, folded; palea oblong-acute, *ca.* 7.5 by 1.2 mm, hyaline, glabrous, folded. *Upper floret*; lemma oblong-acute, *ca.* 7.5 by 1.5 mm, hyaline, hairy along margins, folded; palea oblong-acute, *ca.* 8 by 1 mm, hyaline, slightly hairs along the upper margins, folded. *Lodicule* cuneate, *ca.* 0.8 mm long. *Ovary* ellipsoid, *ca.* 1 mm long. *Pedicelled spikelet* very similar to but smaller than the sessile spikelets. *Pedicels* cuneate, flattened, 7–8 mm long, scabrous along margins. *Glumes*; lower glume oblong-ovate, 2.3–2.4 by 2.5–2.8 mm, glabrous on the back, with scabrous margins, with long caudate apex; upper glume oblong-ovate or boat-shaped, *ca.* 8.5 by 2 mm, keeled on the upper back, scabrous along keeled, upper margins hairy, apex acute. *Lower floret*; lemma oblong-acute, *ca.* 7 by 1.5 mm, hyaline, glabrous, folded; paleas oblong-ovate, *ca.* 6.5 by 1 mm, hyaline, folded, apex acute, glabrous. *Upper floret*; lemma oblong-ovate, *ca.* 6.5 by 1 mm, hyaline, glabrous slightly folded; palea ovate, *ca.* 6.5 by 1.5 mm, hyaline, hairy along the upper margins, folded (Figs. 5.26 & 5.49).

Thailand.— CENTRAL: Krung Thep Maha Nakhon [Bang Khen, 1 Oct. 1960, *C. Chermsirivathana* s.n. (BK)].

Distribution.— Throughout tropical Africa and Southeast Asia.

Ecology.— Growing on the canal banks, at sea level. Flowering in October.

Notes.— Only one collection of *V. cuspidata* in BK herbarium has been recorded.

Figure 5.26 *Vossia cuspidata*: A. plant; B. & C. spikelet pairs; D. upper glume of the sessile spikelet with joint. All line drawings were drawn by P. Traiperm from *C. Chermsirivathana* s.n. (BK).

5.3 Discussion and Conclusion

5.3.1 Ecology

Ecological data of the subtribes Ischaeminae and Rottboelliinae in Thailand are summarized in Table 5.1.

Table 5.1 Ecological data of the subtribes Ischaeminae and Rottboelliinae in Thailand.

Taxa	Habit	Habitat	Altitude (m)	Flowering periods
Subtribe Ischaeminae				
1. *Apluda mutica*	perennial	df	0-2,000	Aug.-May
2. *Ischaemum barbatum*	perennial	pdf, swp	0-1,300	All year round
3. *I. barbatum* var. *lodiculare*	perennial	pf	50-1,300	Jun.-Mar.
4. *I. hansenii*	perennial	bf	0	Nov.
5. *I. hirtum*	annual	ns, rs	50-1,300	Nov.-Dec.
6. *I. hubbardii*	perennial	svn	1,950-2,350	Oct.-Nov.
7. *I. indicum*	perennial	rs, svn, swp, pdf	0-1,950	Sept.-Apr.
8. *I. lacei*	perennial	–	–	Nov.
9. *I. magnum*	perennial	rv	0-280	Sept.-Apr.
10. *I. muticum*	perennial	bf	0	All year round
11. *I. rugosum*	annual	pdf, rs	0-800	Apr.-Jan.
12. *I. tenuifolium*	perennial	dtf, sf	0-125	Oct.-Dec.
13. *I. timorense*	annual	rs, ef, ns, svf	0-1,500	Nov.-Mar.
14. *I.* sp.1	annual	ef	1,450	Dec.-Mar.
15. *I.* sp.2	perennial	svn, swp	0-600	Nov.-Mar.
16. *Kerriochloa siamensis*	perennial	sf	140-600	Oct.-Dec.
17. *Sehima nervosum*	perennial	dtf	0-950	Sept.-Apr.
18. *Thelepogon elegans*	annual	df, rs	50-300	Oct.-Dec.
Subtribe Rottboelliinae				
19. *Eremochloa attenuata*	perennial	dtf	450-1,800	Nov.-May
20. *E. bimaculata*	perennial	dtf	50-650	May-Sept.
21. *E. ciliaris*	perennial	dtf, df, pf	0-2,200	All year round
22. *E. ciliatifolia*	annual	dtf, pf	250-1,300	May-Nov.
23. *E. eriopoda*	perennial	dtf, df	0-210	Aug.-Jan.

Table 5.1 Ecological data of the subtribes Ischaeminae and Rottboelliinae in Thailand (Cont.).

Taxa	Habit	Habitat	Altitude (m)	Flowering periods
24. *E. lanceolata*	annual	sf, dtf	125	Oct.
25. *E. maxwellii*	perennial	df	125	Oct.
26. *E. muricata*	perennial	df	0-50	Jul.-Nov.
27. *E. peltelotii*	perennial	pdf	250	Sept.-Dec.
28. *E.* sp.1	perennial	dtf	300	Aug.-Sept.
29. *E.* sp.2	annual	ns	1,300	Oct.
30. *Hackelochloa granularis*	annual	dtf	1,450	Jul.-Mar.
31. *H. porifera*	annual	bb, wd	1,500	Sept.-Nov.
32. *Hemarthria altissima*	perennial	pf	1,300	Mar.
33. *H. compressa*	perennial	swp, rs	1,300	Mar.-Nov.
34. *H. debilis*	annual	swp	50	Jul.
35. *H. longiflora*	perennial	swp	5-2,350	Apr.-Oct.
36. *H. pratensis*	perennial	pf	1,300	Oct.-Mar.
37. *H. stolonifera*	perennial	swp	0	Jun.
38. *Mnesithea cancellata*	perennial	df, swp	50-1,300	Jul.-Apr.
39. *M. glandulosa*	perennial	ns, df	0-1,100	May-Jan.
40. *M. helferi*	perennial	ef, df, swp	25-200	Apr.-Dec.
41. *M. laevis*	perennial	df, dtf, pf	400	Jul.-May
42. *M. mollicoma*	perennial	df	1,200	All year round
43. *M. striata*	perennial	dtf, ef	1,225	Jun.-Feb.
44. *M. striata* var. *pubescens*	perennial	df	100-2,200	Sept.-Apr.
45. *M. thailandica*	perennial	pdf	100	Jun.
46. *M.* sp.1	perennial	pf	60-1,800	Jun.-Mar.
47. *Ophiuros exaltatus*	perennial	svn	800-2,200	Oct.-Dec.
48. *Phacelurus cambogiensis*	perennial	swp	200-250	Aug.-Dec.
49. *P. zea*	perennial	pdf	800-900	Jun.-Dec.
50. *Rottboellia cochinchinensis*	annual	wd	0-1,300	All year round
51. *Vossia cuspidata*	perennial	rs	0	Oct.
Total number of taxa: 51				

habitat: bb = bamboo forest, bf = beach forest, dtf = dipterocarp forest, ef = evergreen forest, sf = sandstone forest, ns = near stream, rv = rivers sides, df =

deciduous forest, pf = pine forest, sf = secondary forest; rs = roadsides, svn = savannah, swp = swampy area, pdf = paddy field, weedy area = wd; – = no data.

It can be seen that grass members of the subtribe Ischaeminae can grow in many types of habitat from sea level up to high altitude (2,350 m). They can be found along roadside (5 taxa), paddy field (3 taxa), swampy area (3 taxa) and savannah (3 taxa). Some species occur in deciduous forest (2 taxa), beach forest (2 taxa), near stream (2 taxa), dipterocarp forest (2 taxa), secondary forest (2 taxa) and evergreen forests (2 taxa). Two species is restricted to rivers sides (*Ischaemum magnum*) and pine forest (*I. barbatum* var. *lodiculare*). The Ischaeminae plants in commonly produce flowers in November to December but only two species, *I. barbatum* and *I. muticum* produce a flower all year round.

In the subtribe Rottboelliinae, the grass can be found from sea level up to high elevation (2,350 m). Most species are often found in dry dipterocarp forest or dry deciduous forest, each comprising of 10 taxa. However, nine and seven taxa are also observed in pine forest and swampy area, respectively. There are few taxa occasionally found near stream (2 taxa), weedy area (2 taxa), along roadsides (2 taxa) and in evergreen forest (2 taxa). Three species were reported in different habitat such as in bamboo forest (*Hackelochloa porifera*), sandstone forest (*Eremochloa lanceolata*) and savannah (*Ophiuros exaltatus*). The flowering period is between August and November. *E. ciliaris*, *Mnesithea mollicoma* and *Rottboellia cochinchinensis* produce flowers throughout the year.

5.3.2 Distribution

Most species of Ischaeminae are recorded in the penninsula (12 taxa), south-eastern (10 taxa), eastern (10 taxa) and northern (9 taxa) Thailand, while Rottboelliinae are mostly distributed in the north-eastern (22), eastern regions (21 taxa) and northern regions (14 taxa) (Table 5.2). Some taxa in both subtribes can be found throughout the country, especially *Apluda mutica*, *Ischaemum indicum, I. rugosum, Mnesithea glandulosa* and *Rottboellia cochinchinensis* which are distributed in all floristic regions (Table 5.2).

Table 5.2 The distributions of the Ischaeminae and Rottboelliinae in Thailand.

Taxa	Floristic Regions of Thailand						
	N	NE	E	SW	C	SE	PEN
Subtribe Ischaeminae							
1. *Apluda mutica* (C)	/	/	/	/	/	/	/
2. *Ischaemum barbatum* (C)	/	/	/	–	/	/	/
3. *I. barbatum* var. *lodiculare*	–	/	/	–	–	/	/
4. *I. hansenii* * (R)	–	–	–	–	–	–	/
5. *I. hirtum*	–	/	/	–	–	–	/
6. *I. hubbardii* (R)	/	–	–	–	–	–	–
7. *I. indicum* (C)	/	/	/	/	/	/	/
8. *I. lacei* (R)	/	–	–	–	–	–	–
9. *I. magnum*	–	–	–	–	/	–	/
10. *I. muticum*	–	–	–	–	–	/	/
11. *I. rugosum* (C)	/	/	/	/	/	/	/
12. *I. tenuifolium*	–	/	/	–	–	/	–
13. *I. timorense*	/	–	–	/	/	–	/
14. *I.* sp.1 *, ***	–	–	–	–	–	/	/
15. *I.* sp.2 *, ***	–	–	–	–	–	–	/
16. *Kerriochloa siamensis*	–	–	/	–	–	/	–
17. *Sehima nervosum*	/	/	/	/	–	/	–
18. *Thelepogon elegans*	/	–	/	–	/	–	–
Subtribe Rottboelliinae							
19. *Eremochloa attenuata* *	/	/	–	–	–	–	–
20. *E. bimaculata*	–	–	/	/	–	/	–
21. *E. ciliaris* (C)	/	/	/	/	–	/	/
22. *E. ciliatifolia*	–	/	/	–	–	/	–
23. *E. eriopoda*	–	/	/	–	–	–	–
24. *E. lanceolata* *	–	–	/	–	–	–	–
25. *E. maxwellii* *	–	–	/	–	–	–	–
26. *E. muricata* (R)	–	–	–	/	–	–	–
27. *E. peltelotii* (R)	–	–	/	–	–	–	–
28. *E.* sp.1 *, ***	–	/	/	–	–	–	–
29. *E.* sp.2 *, ***	–	/	–	–	–	–	–

Table 5.2 The distributions of the Ischaeminae and Rottboelliinae in Thailand (Cont.).

Taxa	Floristic Regions of Thailand						
	N	**NE**	**E**	**SW**	**C**	**SE**	**PEN**
30. *Hackelochloa granularis*	/	/	–	–	–	/	–
31. *H. porifera*	/	–	–	–	–	–	–
32. *Hemarthria altissima*	–	/	–	–	–	–	–
33. *H. compressa*	/	/	/	–	/	/	–
34. *H. debilis* * (R)	–	–	–	–	–	/	–
35. *H. longiflora*	/	/	/	/	/	/	–
36. *H. pratensis*	–	/	–	–	–	–	–
37. *H. stolonifera* * (R)	–	–	–	–	–	/	–
38. *Mnesithea cancellata*	/	/	/	–	–	–	–
39. *M. glandulosa* (C)	/	/	/	/	/	/	/
40. *M. helferi*	–	/	/	/	/	/	/
41. *M. laevis*	/	/	/	/	–	/	/
42. *M. mollicoma*	/	/	/	–	–	/	/
43. *M. striata*	/	/	/	/	–	–	/
44. *M. striata* var. *pubescence* **	/	/	/	/	–	–	/
45. *M. thailandica* *, *** (R)	–	–	/	–	–	–	–
46. *M.* sp.1*, ***	/	–	–	/	–	–	–
47. *Ophiuros exaltatus*	–	/	/	–	/	–	–
48. *Phacelurus cambogiensis* (R)	–	/	–	–	–	–	–
49. *P. zea*	–	/	/	–	–	–	–
50. *Rottboellia cochinchinensis* (C)	/	/	/	/	/	/	/
51. *Vossiacuspidata* (R)	–	–	–	–	/	–	–
Total number of taxa	**24**	**31**	**31**	**16**	**14**	**24**	**20**

* indicate endemic to Thailand, ** = new record for Thailand, and *** = probably new to science, C = common species, R = rare species, N = Northern, NE = North-Eastern, E = Eastern, SW = South-Western, C = Central, SE = South-Eastern, PEN = Peninsular, / = present, – = absent.

According to the study, twelve endemic taxa are endemic species to Thailand. Three taxa of Ischaeminae and nine taxa of Rottboelliinae are presently known from

one or two floristic regions, one or several localities in each region. Those taxa are listed as follow:

1. *Ischaemum hansenii* is restricted to Trang (Ko Talibong).

2. *I.* sp. 1 is found in Chanthaburi (Khao Soi Dao) and Krabi (Phanom Bencha).

3. *I.* sp.2. This species is only found in Ranong (Phu Khao Yah).

4. *Eremochloa attenuata* is recorded in Chiang Mai [Doi Inthanon, Doi Suthep, near Fang, Wang Bua Ban), Lamphun (between Tak & Lamphun, Khun Tan National Park), Lampang (Ngao Mae Huad), Loei (Phu Kradueng).

5. *E. lanceolata* is presented in Nakhon Ratchasima (Khao Kuap), Ubon Ratchathani (Pha Taem National Park, Warin Chamrap).

6. *E. mawellii* is found in Si Sa Ket (Dongrak, Kantharalak), Ubon Ratchathani (Warin Chamrap).

7. *E.* sp.1 only occurs in Khon Kaen (Khok Phu Taka), Chaiyaphum (Nong Bua Daeng), Nakhon Ratchasima (Huai Thalaeng).

8. *E.* sp.2 is confined to Loei (Phu Kradueng).

9. *Hemarthria debilis* is limited to Chanthaburi (Makham).

10. *H. stolonifera* is restricted to Chanthaburi (Makham).

11. *Mnesithea thailandica* is confined to Roi Et (Suwanaphoom).

12. *M.* sp. 1 is only recorded in Mae Hong Son (Pai), Chiang Mai (Doi Suthep, Doi Inthanon, Chiang Doi Hills, Doi Chiang Dao, Pha Hom Pok, Wang Tao, Khun wang highland, Mae John Luang), Kanchanaburi (Huai Bankau).

Moreover, there are 12 taxa are not endemic to Thailand, but rather have a restricted distribution, either confined to one or two floristic regions or found in a single locality. Further works are needed to determine the population size and their distribution. Those taxa are listed as follow:

1. *Ischaemum hirtum* is recorded in Phetchabun (Nam Nao National Park) and Chaiyaphum (Nam Phrom).

2. *I. hubbardii* is limited to Chiang Mai (Doi Inthanon).

3. *I. lacei* is restricted to Chiang Mai (Doi Nang Ka).

4. *I. magnum* is confined to Krung Thep Maha Nakhon.

5. *Kerriochloa siamensis* occurred in Ubon Ratchathani (Warin Chamrap, Pha Taem Nat. Park) and Chanthaburi (Kao Knap).

6. *Eremochloa petelotii* is presented in Nakhon Ratchasima (Phimai) and Surin (Thung Kula Rong Hai)

7. *Hackelochloa porifera* is limited to Chiang Mai (nursery of Queen Sirikit Botanical Garden).

8. *Hemarthria altissima* is restricted to Loei (Phu Kradueng).

9. *H. pratensis* is limited to Loei (Phu Kradueung).

10. *Phacelurus cambogiensis* is confined to Nakhon Ratchasima (Phimai: Sai Ngam).

11. *P. zea* is found in Phetchabun (Tung SaLaeng Luang Nat. Park) and Chaiyaphum (Tungkamang).

12. *Vossia cuspidata* is limited to Krung Thep Maha Nakhon (Bang Khen).

Nine taxa have been recorded only once or twice in Thailand from the last two decades and no new or recent collection has been made, *e.g. E. petelotii, H. altissima, H. debilis, H. stolonifera, I. hansenii, I. lacei, M. thailandica, P. cambogiensis* and *V. cuspidata*. Those taxa are listed as follow:

1. *Eremochloa petelotii* is found only in two collections which collected in Nakhon Ratchasima (Phimai) in December 27th, 1958 by *T. Smitinand* and in Surin (Thung Kula Rong Hai, Chumphon Buri) by *S. Sutheesorn* in September 17th, 1972. This species is said to be common in paddy fields, however it could not be found from this study.

2. *Hemarthria altissima* was collected by *T. Smitinand* in Loei (Phu Kradueng, near camp) in March 11th, 1952. It is said to be common among the other grasses in open pine forest at 1,300 m altitude.

3. *H. debilis* is growing on swampy area, at 50 m altitude in Chanthaburi (5 km N of Makham). It is only known from the type specimen that collected by *K. Larsen* in June 15th, 1963.

4. *H. stolonifera* is only known from the type specimen collected by *K. Larsen* in Chanthaburi (Makham) in June 13th, 1963. This species is found creeping on wet place, at sea level.

5. *Ischaemum hansenii* is only known from the type specimen, *B. Hansen & T. Smitinand* that collected in Trang (Ko Talibong) in November 10th, 1966. The plants were creeping on rocks, at sea level.

6. *Ischaemum lacei* has been recorded only once in Thailand in Chiang Mai (Doi Nang Ka) in November 4th, 1930 by *Put.*

7. *Mnesithea thailandica* was collected in Roi Et (Suwanaphoom, Nayai, Ban Hang Hoey) in June 10th, 1982 by *Y. Paisooksantivathana & S. Sutheesorn*. This plant is common in paddy field, at 100 m altitude.

8. *Phacelurus cambogiensis* has been recorded only twice in Thailand. Both collections were collected by *T. Smitinand* from Nakhon Ratchasima (Phimai: Sai Ngam) in August 26th and December 27th, 1958. They are common along edge of swampy area, at 200-250 m altitude.

9. *Vossia cuspidata* has been recorded only once in Krung Thep Maha Nakhon (Bang Khen) in 1960 by *C. Chermsirivathana*. The plant was found growing on the canal bank.

The above mentioned species could not be found from their previously described habitats. Though, they were common in their localities in the past. There are several potential answers for their missing from my surveys such as the possibitity of domination by a new weed species which prevénting the growth of the other plant species. Another answer is that the environment in which those species were found have changed, either naturally or unnaturally, probably due to human disturbance. Change in species flowering periods may also be another reason why the above species could not be found, this also includes the fact that when I went to collect the specimens it was too early or too late for the species to produce flowers, therefore the grass plant was not easily notice and could not be collected.

Three taxa in Ischaeminae and 7 taxa in Rottboelliinae are rare species, while 4 and 3 common taxa have been noted in Ischaeminae and Rottboelliinae, respectively.

5.3.3 New records and new species

Nanakorn & Norsaengsri (2001) have reported a total of 21 and 31 taxa of the subtribes Ischaeminae and Rottboelliinae in Thailand, respectively (Table 5.3). One species of Ischaeminae and one variety of Rottboelliinae are newly recorded for Thailand from this research.

I. hubbardii is found along Kio Mae Pan nature trail, Doi Inthanon National Park, Chiang Mai, characterized by its tuberculate-pilose leaves with a lower glume that has 10–14 distinct nerves and transverse hump on the lower 1/3 of the glume. It is similar to *I. indicum* (Houtt.) Merr. in having glabrous surface on the back of the lower glume of sessile spikelets but differing in the unequal narrow lateral wings above and hairs on both leaf surfaces. The lower glume of the sessile spikelet in the Thai specimens has a transverse, nearly flat hump on the lower 1/3 of the glume although the hump is slightly convex on the back in the type specimen from India. So far, this species has been found at high altitude in India and Thailand and seems to be a member of the Indo-Burmese elements, but no Burmese collection yet. Further work in this area is needed.

M. striata var. *pubescens* is found in north, north-eastern, eastern, south-western and peninsular Thailand. Hairy forms of *M. striata* are segregated at the varietal level in the treatment of the subtribe Rottboelliinae in this study, however this variety is a first record for the country.

There are two species in Ischaeminae and four species in Rottboelliinae which are expected to be new species.

1. *Ischaemum* sp.1 resembles *I. barbatum* in lower glume of the sessile spikelet. However, the latter is easily distinguished by the presence of coarsely ridge more than one across the back or with 2 or more nodules along the margins. *I.* sp. 1 has pubescent leaf-blade on both surface, margins recurved or folded while *I. barbatum* has flattened leaf-blade, both surface glabrous to pilose.

2. *I.* sp.2 is similar to *I. lacei*, but can be distinguished by its glabrous of leaf blade, while the leaf-blade of *I. lacei* is pilose with tubercle-based hairs on both surfaces.

3. *Eremochloa* sp.1 is very closely related to *E. maxwellii* but differs considerably in having obovate with a long cordate pedicel, while obliquely-lanceolate pedicel in *E. maxwellii*. This species is collected from the north-eastern Thailand.

4. *Eremochloa* sp.2 resembles *E. muricata*, but can be distinguished from the latter in having a subulate pedicel, while an obliquely obovoid pedicel in *E. muricata*. This species is only found in Phu Kradueng, Loei.

5. *M. thailandica* P. Traiperm & T. Boonkerd (*ined.*) is distinguished by the appressed hairs on the inflorescence. It is similar to *M. geminata* in Malaysian species, but differs in having a small erect and slender culm, *ca.* 26 cm tall. The species has pubescent hairs on the back of the triangular lower glume, rachis nodes, pedicels and rachis internode, while *M. geminata* has lower glume lanceolate, covered with hirsute hairs below and glabrous on rachis nodes, pedicels and rachis internode.

6. *M.* sp.1 is closely related to *M. striata* in having the lower glume of the sessile spikelet oblong, indurate, 5–5.5 by 1.2–1.5 mm, apex with unequal winges, 7–8 longitudinal rows of small pits between the nerves of the back, margins at base puberulous, while the lower glume of the sessile spikelet ovate, indurate, 4.5–5 by *ca.* 1.5 mm, apex with 2 apical wings, continuously ridged along the length and interrupted by tubercles or tubercle-based hairs on the back or glabrous in *M. striata*.

5.3.4 Comparison with other works

Comparison of the previous studies (Table 5.3), there are eight taxa which are additionally reported from this study, namely *Ischaemum hubbardii*, *I.* sp.1, *I.* sp.2, *Eremochloa* sp.1, *E.* sp.2, *Mnesithea striata* var. *pubescens*, *M. thailandica* and *M.* sp.1. Seven misidentified taxa are found in this study, e.g., *I. mangaluricum* (*I. babartum*), *Sehima sulcatum* (*Andropogon* sp.), *E. zeylanica* (*E. bimaculata*), *M. geminata* (*M. mollicoma*), *Ophiuros bombaiensis* (*M. laevis*), *O. megaphyllus* (*O. exaltatus*) and *Thaumastochloa cochinchinensis* (*M. laevis*).

Nanakorn & Norsaengsri (2001) reported the occurrence of 52 species of the two subtribes in Thailand. However, two species which they previously mentioned, *Ischaemum angustifolium* (Hack.) and *I. fieldingianum* Rendle, can not collect even from their original localities. Furthermore there is no specimen under these names, deposited in any herbaria in Thailand or overseas. It is probably due to missed identified.

Table 5.3 Comparative treatment of Ischaeminae and Rottboelliinae by some authors.

Taxa	Nanakorn & Norsaengsri 2001	Buitenhui & Veldkamp 2001	Present study
1. *Apluda mutica*	/	–	/
2. *Ischaemum angustifolium* ***	/	–	–
3. *I. aristatum*	/	–	=*I. barbatum* Retz.
4. *I. barbatum*	/	–	/
5. *I. barbatum* var. *glaberrimum*	/	–	=*I. barbatum* Retz.
6. *I. barbatum* var. *lodiculare*	/	–	/
7. *I. fieldingianum* ***	/	–	–
8. *I. hansenii*	/	–	/
9. *I. hirtum*	/	–	/
10. *I. hubbardii*	–	–	/
11. *I. indicum*	/	–	/
12. *I. lacei*	/	–	/
13. *I. magnum*	/	–	/
14. *I. mangaluricum* **	/	–	misidentified
15. *I. muticum*	/	–	/
16. *I. rugosum*	/	–	/
17. *I. tenuifolium*	/	–	/
18. *I. timorense*	/	–	/
19. *I.* sp.1 *	–	–	/
20. *I.* sp.2 *	–	–	/
21. *Kerriochloa siamensis*	/	–	/
22. *Sehima nervosum*	/	–	/
23. *S. sulcatum* **	/	–	misidentified
24. *Thelepogon elegans*	/	–	/
25. *Coelorachis cancellata*	/	–	= *M. cancellata*
26. *C. glandulosa*	/	–	= *M. glandulosa*
27. *C. helferi*	/	–	= *M. helferi*
28. *C. mollicoma*	/	–	= *M. mollicoma*
29. *C. striata*	/	–	= *M. striata*
30. *Eremochloa attenuata*	–	/	/
31. *E. bimaculata*	/	–	/
32. *E. ciliaris*	/	–	/

Table 5.3 Comparative treatment of Ischaeminae and Rottboelliinae by selected authors (Cont.).

Taxa	Nanakorn & Norsaengsri 2001	Buitenhui & Veldkamp 2001	Present study
33. *E. ciliatifolia*	/	–	/
34. *E. eriopoda*	/	–	/
35. *E. lanceolata*	–	/	/
36. *E. maxwellii*	–	/	/
37. *E. muricata*	/	–	/
38. *E. peltelotii* Merr.	/	–	/
39. *E. zeylanica* Hack. ***	/	–	misidentified
40. *E.* sp.1 *	–	–	/
41. *E.* sp.2 *	–	–	/
42. *H. granularis*	/	–	/
43. *H. porifera*	/	–	/
44. *Hemarthria altissima*	/	–	/
45. *H. compressa*	/	–	/
46. *H. debilis* Bor	/	–	/
47. *H. longiflora*	/	–	/
48. *H. pratensis*	/	–	/
49. *H. stolonifera*	/	–	/
50. *H. subulata*	/	–	= *H. pratensis*
51. *Mnesithea cancellata*	–	–	/
52. *M. geminata* **	/	–	misidentified
53. *M. glandulosa*	–	–	/
54. *M. helferi*	–	–	/
55. *M. laevis*	/	–	/
56. *M. merquensis*	/	–	= *M. striata*
57. *M. mollicoma*	–	–	/
58. *M. striata*	–	–	/
59. *M. striata* var. *pubescence* *	–	–	/
60. *M. thailandica* *	–	–	/
61. *M.* sp.1 *	–	–	/
62. *Ophiuros bombaiensis* **	/	–	misidentified
63. *O. exaltatus*	–	–	/

Table 5.3 Comparative treatment of Ischaeminae and Rottboelliinae by some authors (Cont.).

Taxa	Nanakorn & Norsaengsri 2001	Buitenhui & Veldkamp 2001	Present study
64. *O. megaphyllus*	/	–	misidentified
65. *Phacelurus cambogiensis*	/	–	/
66. *P. zea*	/	–	/
67. *Rottboellia cochinchinensis*	/	–	/
68. *Thaumastochloa cochinchinensis*	/	–	misidentified
69. *Vossia cuspidata*	/	–	/
Total taxa	52		51

* indicate newly repoted taxa, ** = misidentified taxa, *** = taxa which can not be found the specimen cited to its scientific name, / = present and – = absent.

5.3.5 A taxonomic problems in some genera and species

Coelorachis Brongn. & *Mnesithea* Kunth

Mnesithea has been described previously by the presence of 2 sessile spikelets separated by a pedicel at each rachis node, but this character is now known to be variable. Furthermore, in the present study a pair of sessile spikelets also occur sporadically in the racemes of species that normally have single sessile spikelets.

The genus *Coelorachis* Brongn. differs from the other genera by a free of pedicel and a presence of the pedicelled spikelet, but these characters are unstable. It was found that the lower part are partially or completely fused to the rachis node in several species of *Coelorachis*. The pedicelled spikelet varies from well developed to minute vestige, and its absence in traditional *Mnesithea* is just the final step. Hence, Veldkamp et al. (1986) has treated the genus *Coelorachis* as a synonym of *Mnesithea* Kunth. The result from this present study also support their treatment.

Hackelochloa Kuntze & *Mnesithea* Kunth

Hackelochloa Kuntze, a genus of the Old World tropics. There are two species: *H. granularis* (L.) O. Kuntze and *H. porifera* (Hack.) Rhind. Veldkamp et al. (1986) combined *Hackelochloa* with *Mnesithea* despite their morphological

differences and the aberrant basic number of the chromosome count from *Mnesithea* (Pohl & Davidse, 1971). In this study I treated *Hackelochloa* as distinct genus based on its globose sessile spikelets with wingless lower glumes.

***H. granularis* (L.) O. Kuntze. & *H. porifera* (Hack.) D. Rhind**

According to Veldkamp et al. (1986) the species *H. porifera* has been treated as a synonym of *H. granularis* because they failed to find any representative specimen in the Rijsherbarium and they did not except the different characters of *H. porifera* from *H. granularis* such as robust plant, large-spikelet. After collecting two living specimens and compared with the type specimens of the two species. The type material of *H. porifera* at K, collected from India by *C.B. Clarke* 9752-A (Sikkim, Darjeeling, isotype), showed apparently fairly robust plant with indeed large sessile spikelets with prominent sculpture on lower glumes (Table 5.4). Therefore, I retain *H. porifera* and *H. granularis* as distinct species as was noted by Bor (1960).

Table 5.4 Comparison of some morphological characters of *H. granularis* and *H. porifera*.

Species / Characters	*H. granularis*	*H. porifera*
Habit	culms erect, 15–80 cm tall	culms erect, 50–200 cm tall
Leaf-blade	linear, 2–13 by 1–1.5 cm	broadly linear, 5–30 by 1–2.5 cm
Inflorescence	1–5 racemes, each raceme 5–15 mm long, peduncle 10–30 mm long	2-4 racemes, each raceme 2.5–4.5 cm long, peduncle 3–8 cm long
Size of the lower glume of the sessile spikelet	*ca.* 1.5 mm diam.	*ca.* 2.5 mm long
Sculpture on the lower glume of the sessile spikelet	pitted and tubercled on the back	ridged and reticulate on the back

***Ischaemum indicum* (Houtt.) Merr.**

The extreme variations of hairiness and size and form of an apical wings in lower glume of the sessile spikelet are certainly distinct (Bor, 1960). However, they are connected by a complete series of intermediates. So it seems better not to divide

this species into a number of infraspecific species at present, but a monographic study is needed to clear the taxonomic status of this species.

5.3.6 Lectotypification

The Lectotypification of five taxa in the subtribe Ischaeminae are made. They are *Ischaemum aristatum* subsp. *imberbe* var. *imbricatum* (synonym of *I. barbatum*), *I. aristatus* var. *arfakense* (synonym of *I. barbatum*), *I. lacei*, *I. magnum* and *I. macrurum* (synonym of *I. timorense*).

5.3.7 New combination

Careful examination of recent collections of *I. tenuifolium* proved that this species does indeed belong to the genus *Andropogon*. The plants have digitate racemes, 3–7 racemes, 6–12 cm long, borne upon subequal flattened raceme-bases and the lower glume of sessile spikelet concave. These are all diagnostic features of *Andropogon* (Clayton & Renvoize, 1986). This study also presented a detailed anatomical description of the genus but these species fail to comform completely to the general pattern in the genus *Ischaemum*. So, *I. tenuifolium* is transfered to be a member of the genus *Andropogon*.

5.3.8 New Synonymy

Bor (1962a) described a new variety of *I. barbatum* from Chiang Mai: Doi Suthep, northern Thailand as *I. barbatum* var. *glaberrimum*. After carefully studied the types of the species and variety I found that they are conspecific. Therefore, the latter variety is reduced to a synonym of the former.

Figure 5.27 *Apluda mutica*: A. habit. *Ischaemum barbatum* var. *barbatum*: B. & C. inflorescence. *I. barbatum* var. *lodiculare*: D. inflorescence.

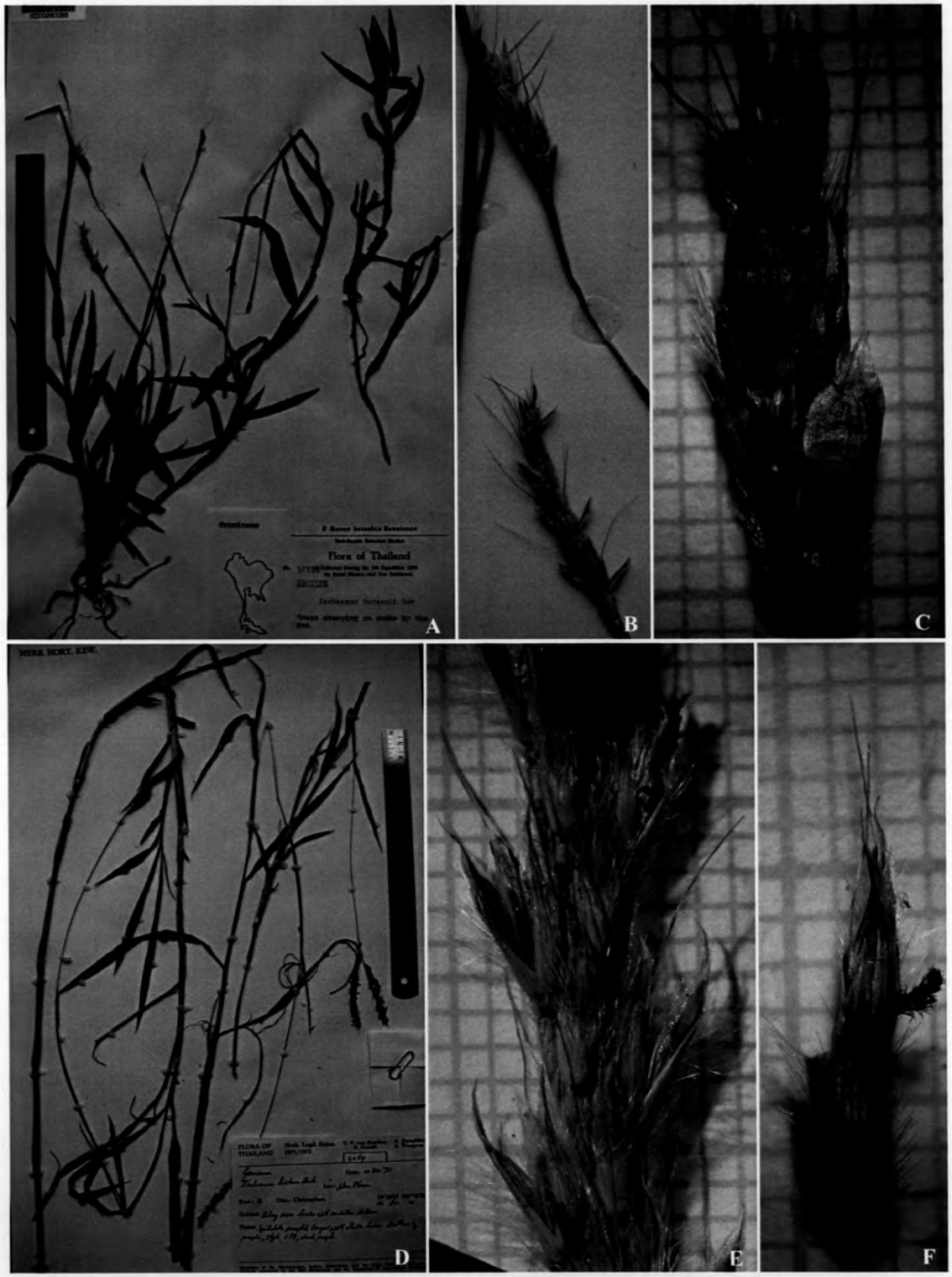

Figure 5.28 A-C. *Ischaemum hansenii*: A. plant; B. inflorescence; C. spikelet in pairs. D-F. *I. hirtum*: D. plant; E. partial inflorescence; F. spikelet in pairs.

Figure 5.29 A. & B. *Ischaemum hubbardii*: A. habit; B. inflorescence. C-E. *I. indicum*: C. habit; D. inflorescence; E. partial inflorescence.

Figure 5.30 A. & B. *Ischaemum lacei*: A. plant; B. inflorescence. C-E. *I. magnum*: C. plant; D. inflorescence; E. spikelet in pairs.

Figure 5.31 A. & B. *Ischaemum muticum*: A. habit; B. inflorescence. C-E. *I. rugosum*: C. habit; D. inflorescence; E. partial inflorescence.

Figure 5.32 A-C. *Ischaemum timorense*: A. plant; B. inflorescence; C. partial inflorescence. D. & E. *I.* sp.1: D. habit; E. inflorescence.

Figure 5.33 A-B. *Kerriochloa siamensis*: A. habit; B. partial inflorescence. C-E. *Sehima nervosum*: C. habit; D. & E. partial inflorescence. F-I. *Thelepogon elegans*: F. habit; G. leaf-sheath and leaf blade; H. partial inflorescence; I. inflorescences.

Figure 5.34 A-C. *Eremochloa attenuata*: A. plant; B. partial inflorescence; C. lower glume, upper glume and joint with pedicelled spikelet. D-F. *E. bimaculata*: D. habit; E. partial inflorescence; F. reversed of partial inflorescence.

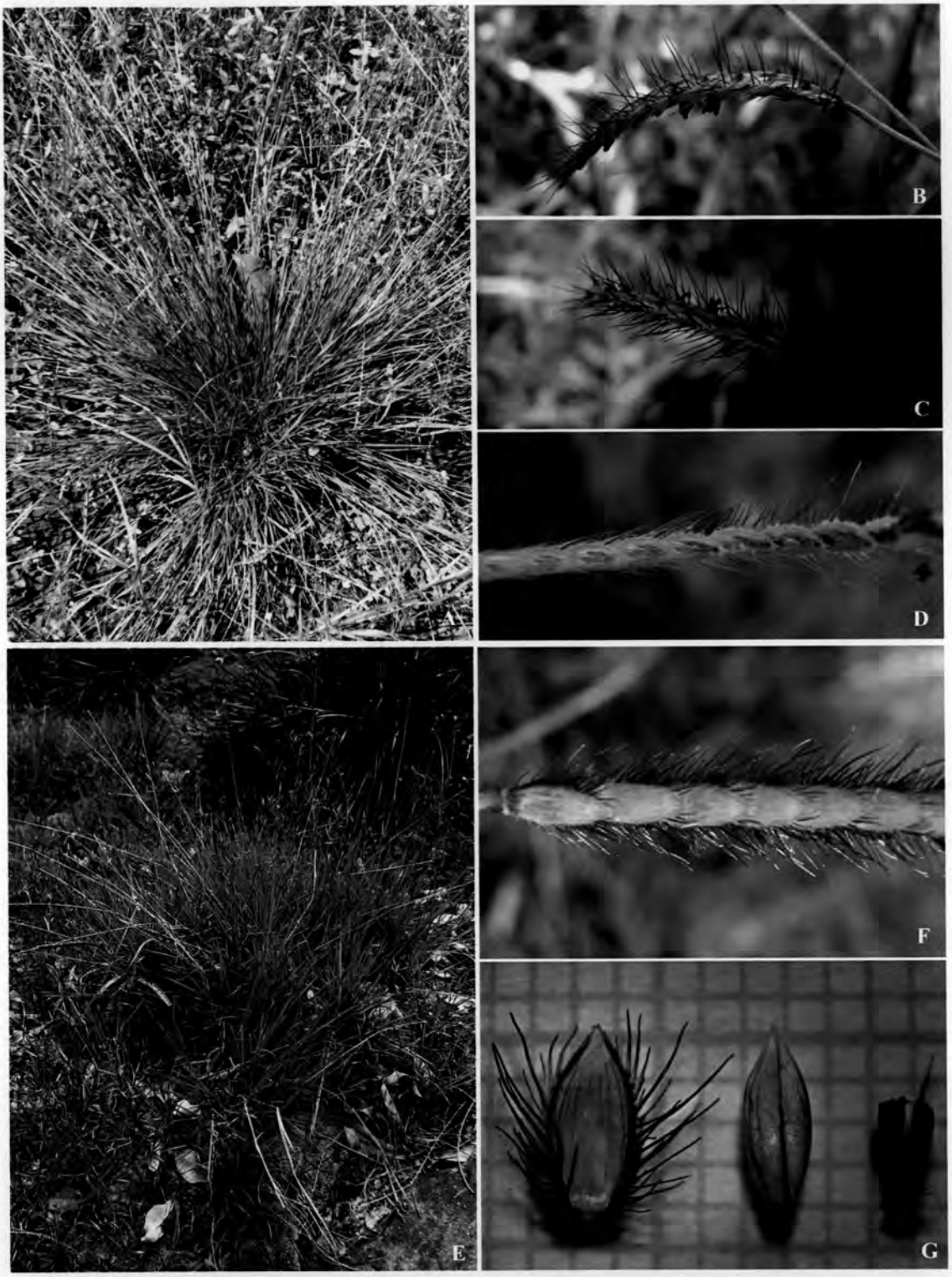

Figure 5.35 A-D. *Eremochloa ciliaris*: A. habit; B-D. inflorescence. E-G. *E. ciliatifolia*: E. habit; F. partial inflorescence; G. lower glume, upper glume and joint with pedicelled spikelet.

Figure 5.36 A-C. *Eremochloa eriopoda*: A. habit; B. inflorescence; C. lower glume, upper glume and joint with pedicelled spikelet. D-F. *E. lanceolata*: D. habit; E. inflorescence; F. lower glume, upper glume and joint with pedicelled spikelet.

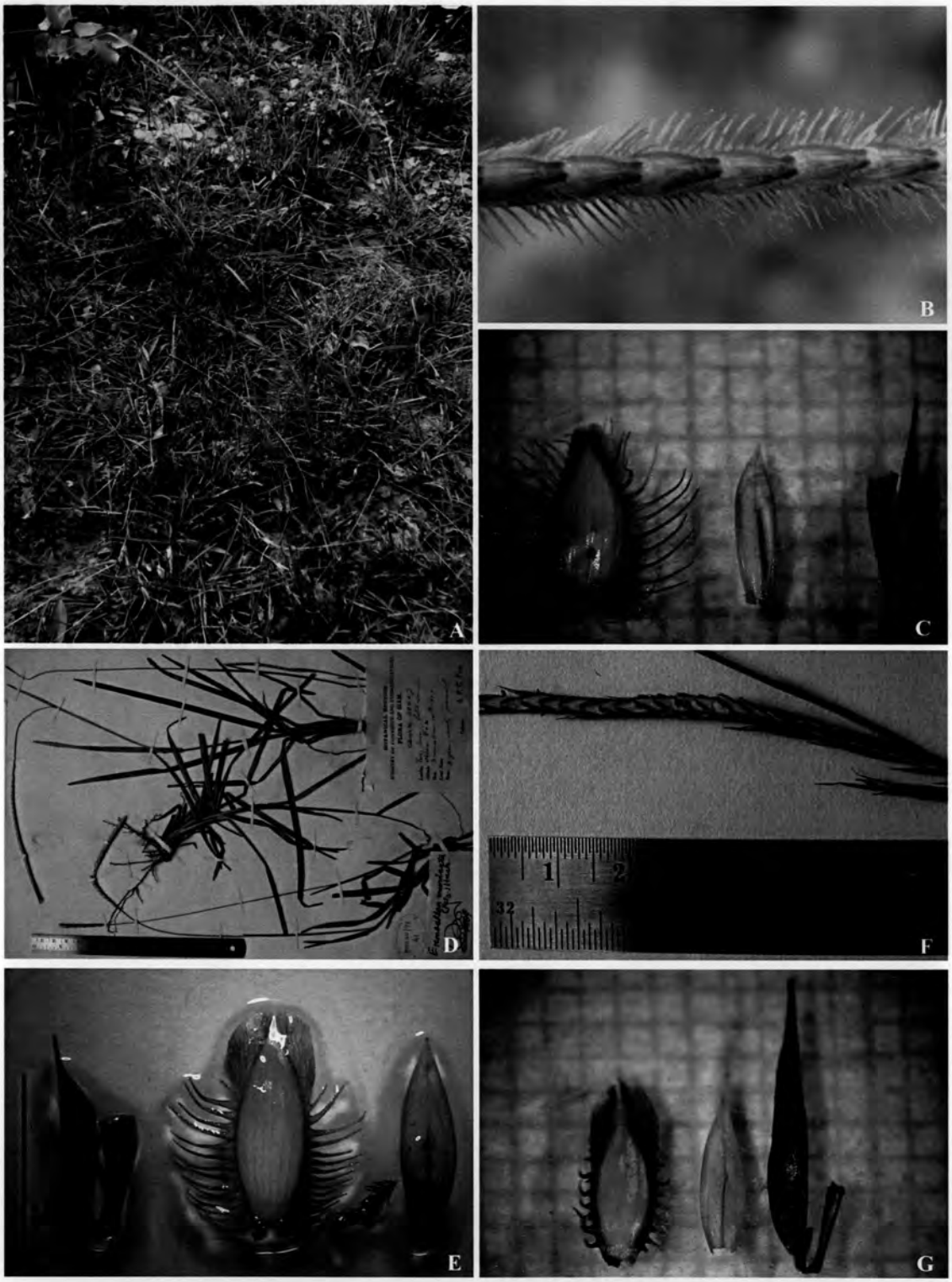

Figure 5.37 A-C. *Eremochloa maxwellii*: A. habit; B. partial inflorescence; C. lower glume, upper glume and joint with pedicelled spikelet. D. & E. *E. muricata*: D. plant; E. lower glume, upper glume and joint with pedicelled spikelet. F. & G. *E. peltelotii* F. partial inflorescence; G. lower glume, upper glume and joint with pedicelled spikelet.

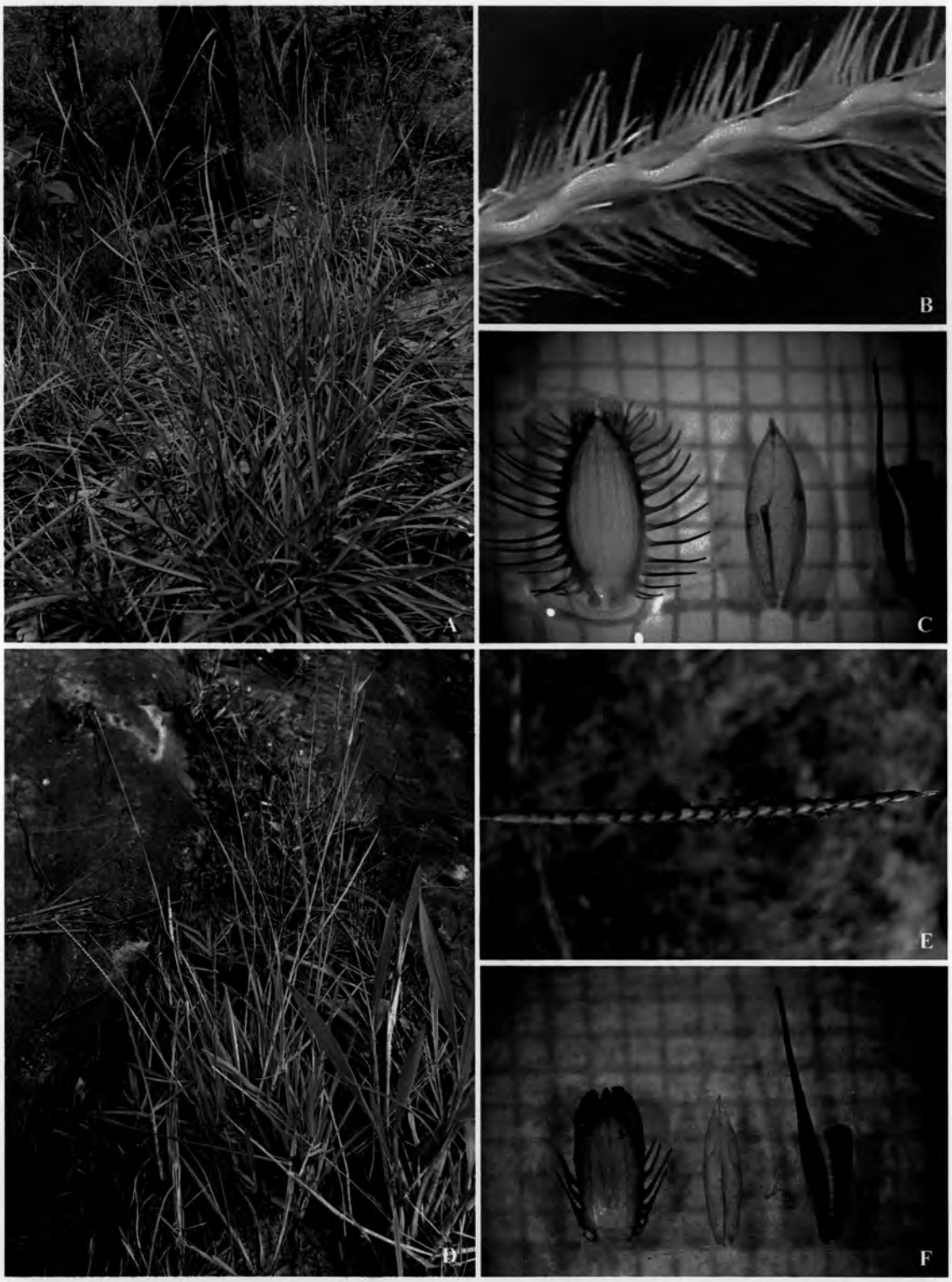

Figure 5.38 A-C. *Eremochloa* sp.1: A. habit; B. partial inflorescence; C. lower glume, upper glume and joint with pedicelled spikelet. D-F. *Eremochloa* sp.2: D. habit; E. inflorescence; F. lower glume, upper glume and joint with pedicelled spikelet.

Figure 5.39 A. & B. *Hackelochloa granularis*: A. habit; B. inflorescence. C-E. *H. porifera*: C. habit; D. & E. inflorescence.

Figure 5.40 A-D. *Hemarthria altissima*: A. plant; B. partial inflorescence; C. lower glume of sessile spikelet; D. lower glume and upper glume of pedicelled spikelet. E-J. *H. compressa*: E. habit; F. inflorescence; G. & H. partial inflorescence; I. lower glume of sessile spikelet; J. lower glume and upper glume of pedicelled spikelet.

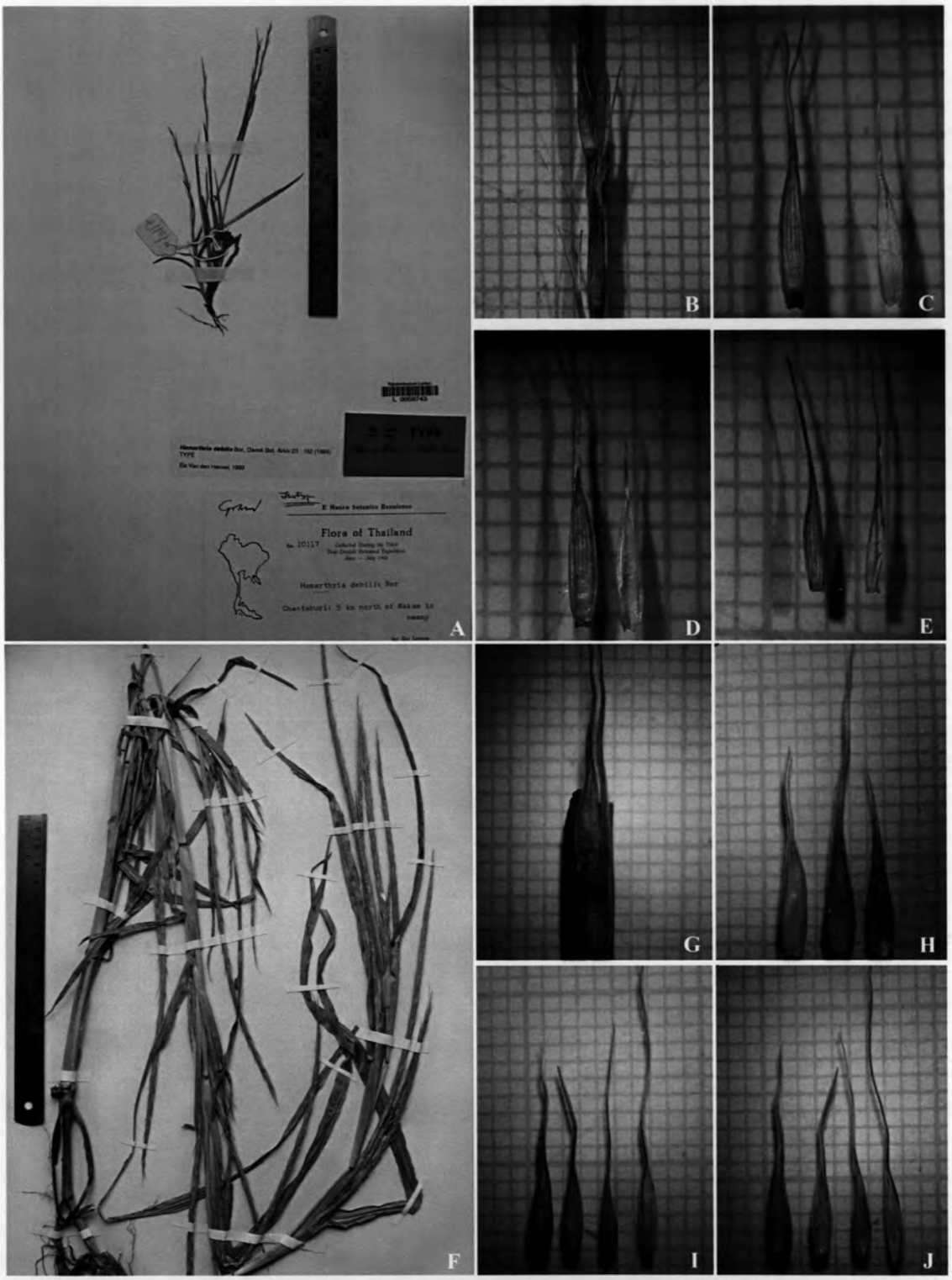

Figure 5.41 A-E. *Hemarthria debilis*: A. plant; B. partial inflorescence; C. lower glume and upper glume of sessile spikelet; D. reverse of lower glume and upper glume of sessile spikelet; E. lower glume and upper glume of pedicelled spikelet. F-J. *H. longiflora*: F. plant; G. partial inflorescence; H. varies of lower glume of sessile spikelet; I. variations of lower glume of pedicelled spikelet; J. reversed of lower glume of pedicelled spikelet.

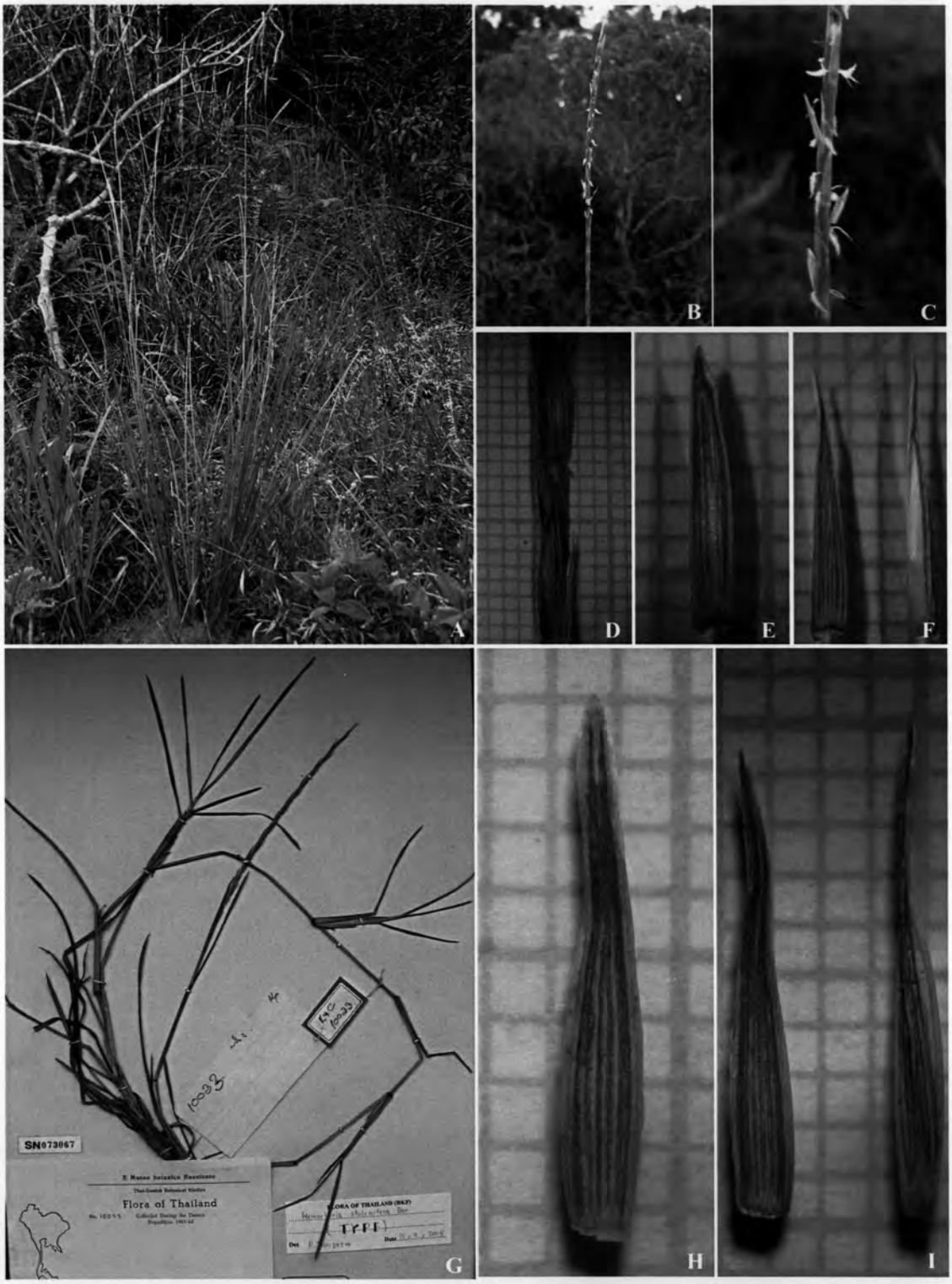

Figure 5.42 A-F. *Hemarthria pratensis*: A. habit; B. partial inflorescence; C. & D. partial inflorescence; E. lower glume of sessile spikelet; F. lower glume and upper glume of pedicelled spikelet. G-I. *H. stolonifera*: G. plant; H. lower glume of sessile spikelet; I. lower glume and upper glume of pedicelled spikelet.

Figure 5.43 A. & B. *Mnesithea cancellata*: A. habit; B. partial inflorescence. C-E. *M. glandulosa*: C. habit; D. inflorescence; E. partial inflorescence.

Figure 5.44 A. & B. *Mnesithea helferi*: A. habit; B. partial inflorescence. C-E. *M. laevis*: C. habit; D. & E. partial inflorescence.

Figure 5.45 A-C. *Mnesithea mollicoma*: A. plant; B. young inflorescence; C. partial inflorescence. D-F. *M. striata*: D. habit; E. & F. partial inflorescence.

Figure 5.46 A-D. *Mnesithea thailandica*: A. plant; B. inflorescence; C. spikelets with a joint; D. pedicel with pedicelled spikelet and lower glume of the sessile spikelet. E-G. *M.* sp.1: E. habit; F. inflorescence; G. partial inflorescence.

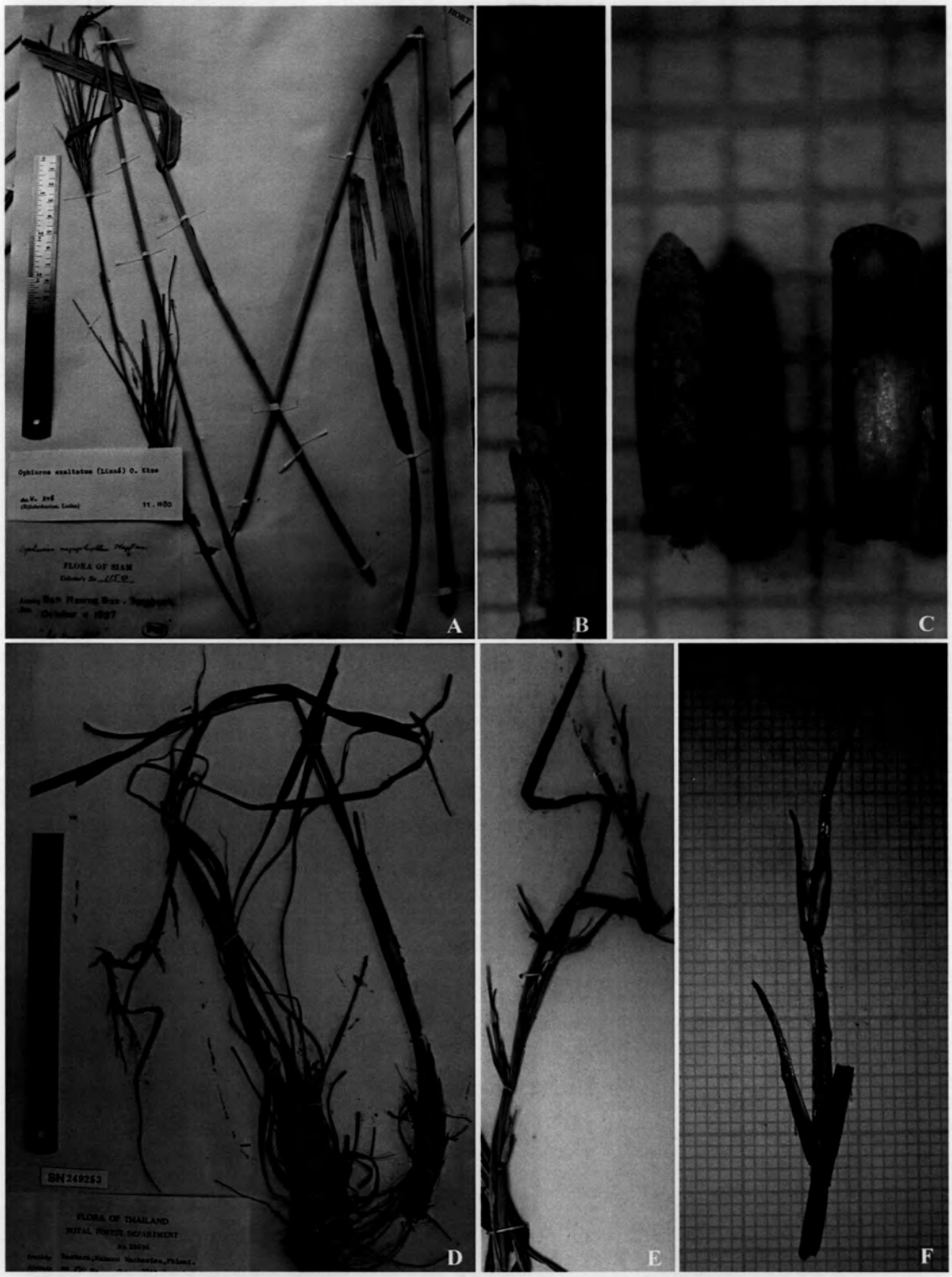

Figure 5.47 A-C. *Ophiuros exaltatus*: A. plant; B. partial raceme; C. lower glume of sessile spikelet and joint. D-F. *Phacelurus cambogiensis*: D. plant; F. partial inflorescence; G. spikelet in pairs.

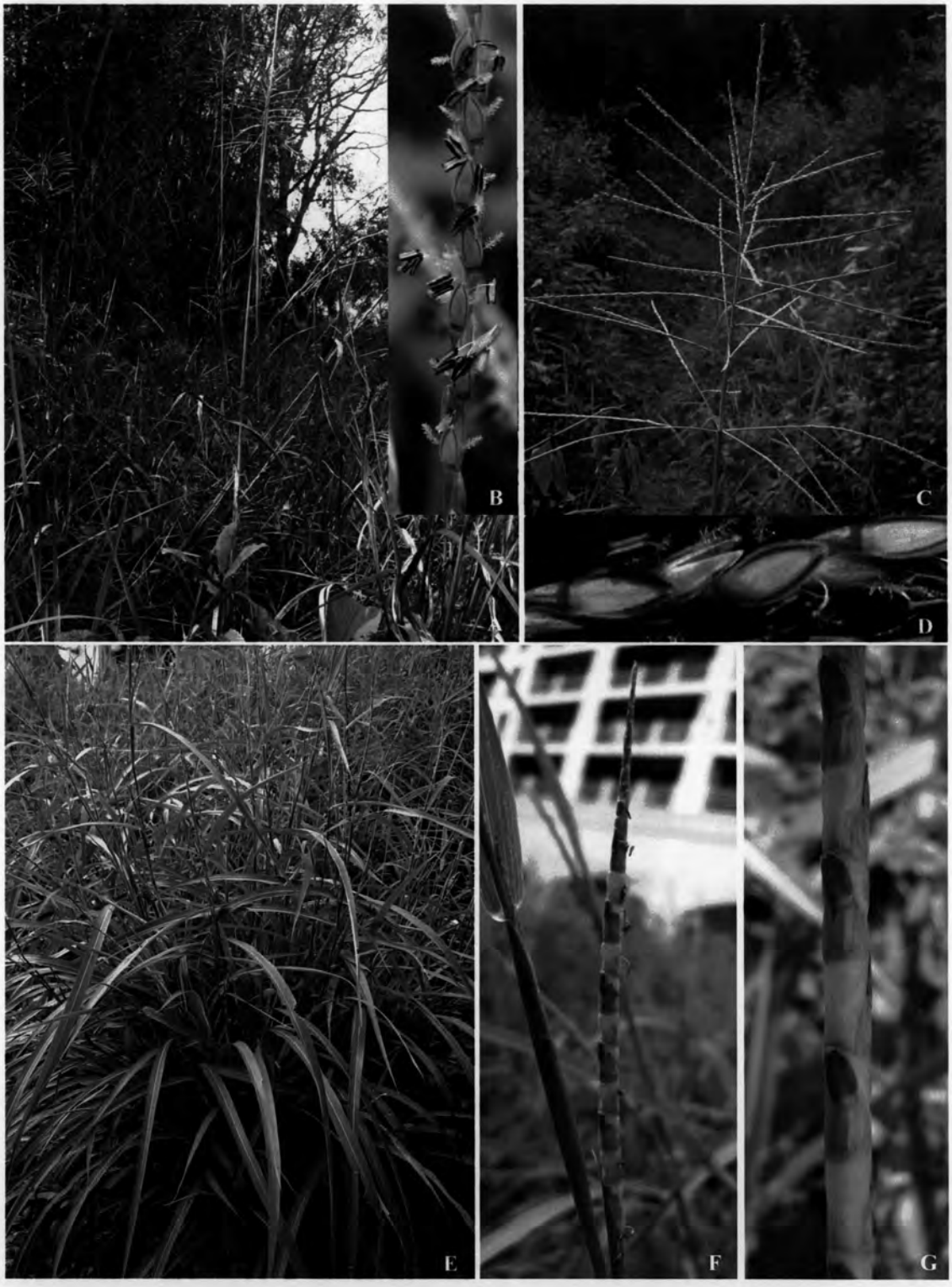

Figure 5.48 A-D. *Phacelurus zea*: A. habit; B. partial raceme; C. panicle inflorescence; D. partial raceme. E-G. *Rottboellia cochinchinensis*: E. habit; F. inflorescence; G. partial inflorescence.

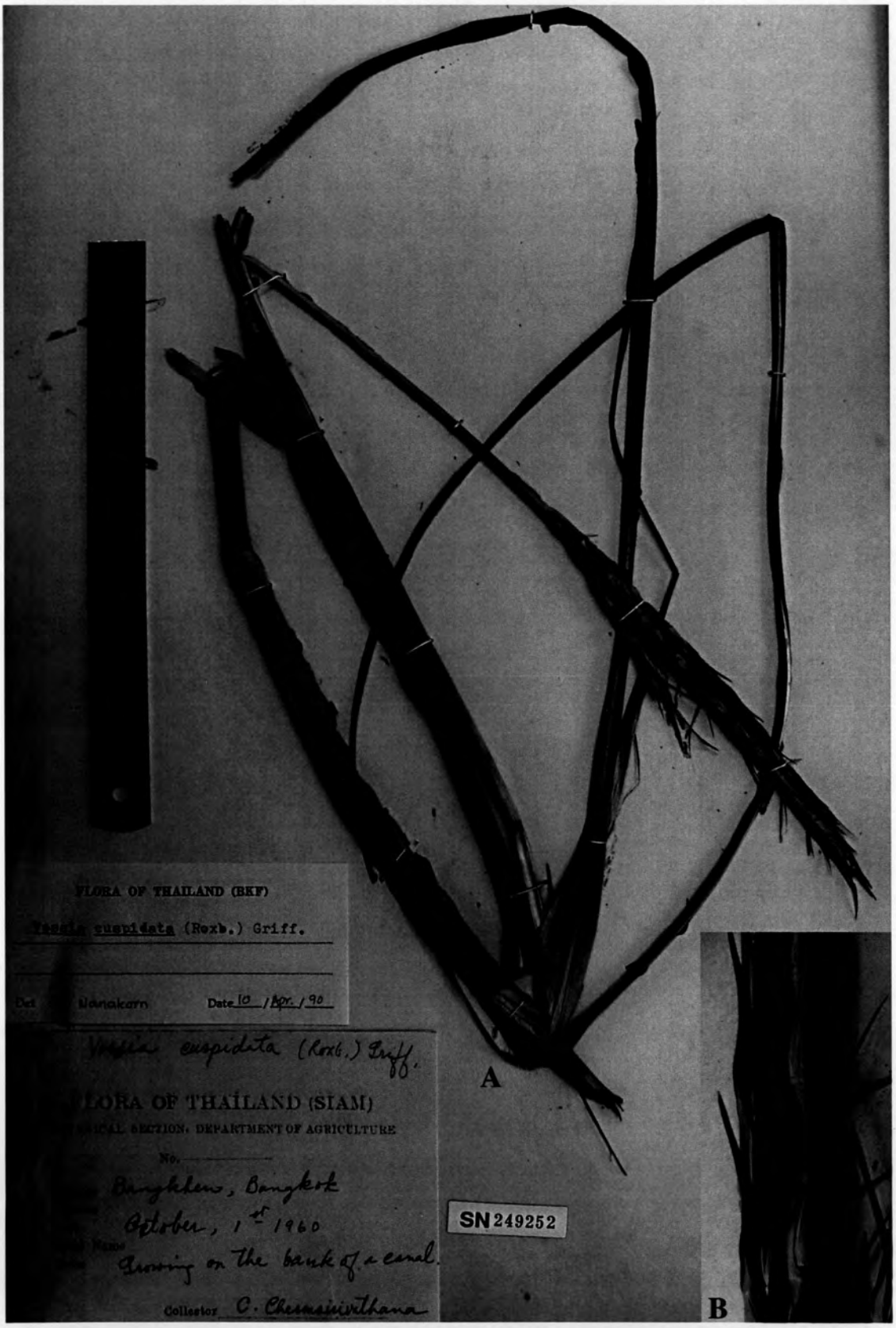

Figure 5.49 *Vossia cuspidata*: A. whole plant; B. partial inflorescence.

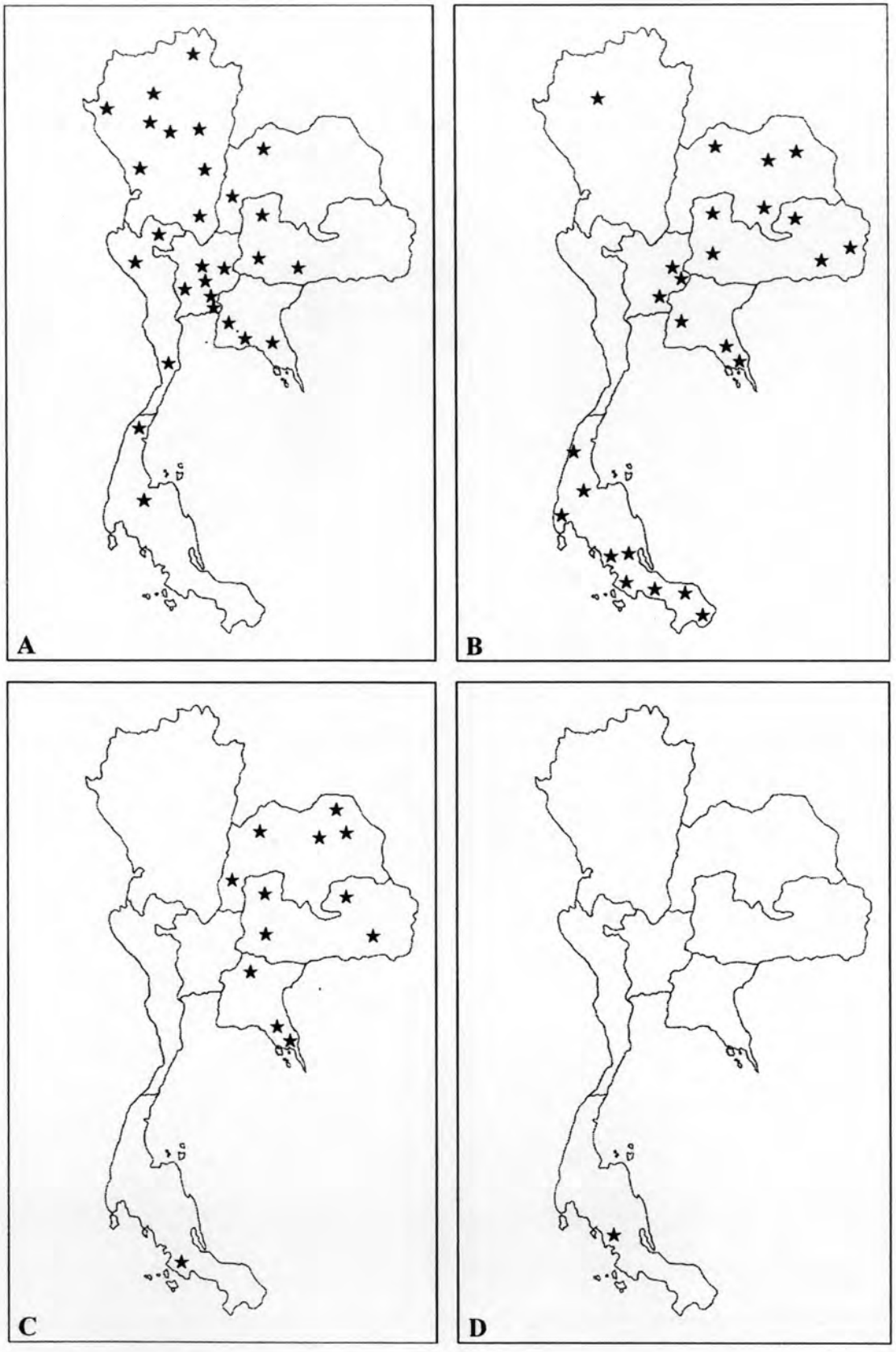

Figure 5.50 Distribution of *Apluda mutica* (A), *Ischaemum barbatum* (B), *I. barbatum* var. *lodiculare* (C) and *I. hansenii* (D).

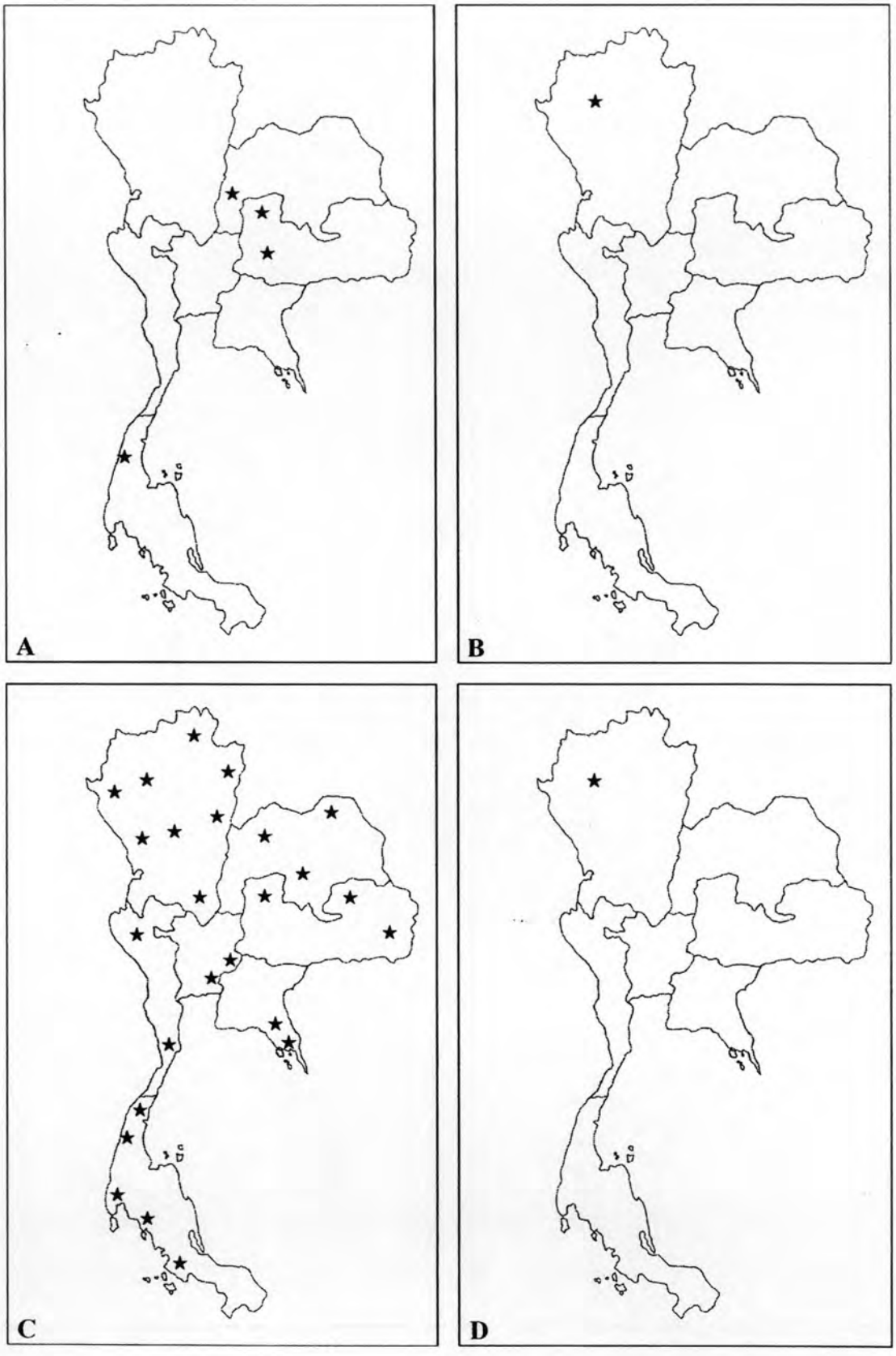

Figure 5.51 Distribution of *Ischaemum hirtum* (A), *I. hubbardii* (B), *I. indicum* (C) and *I. lacei* (D).

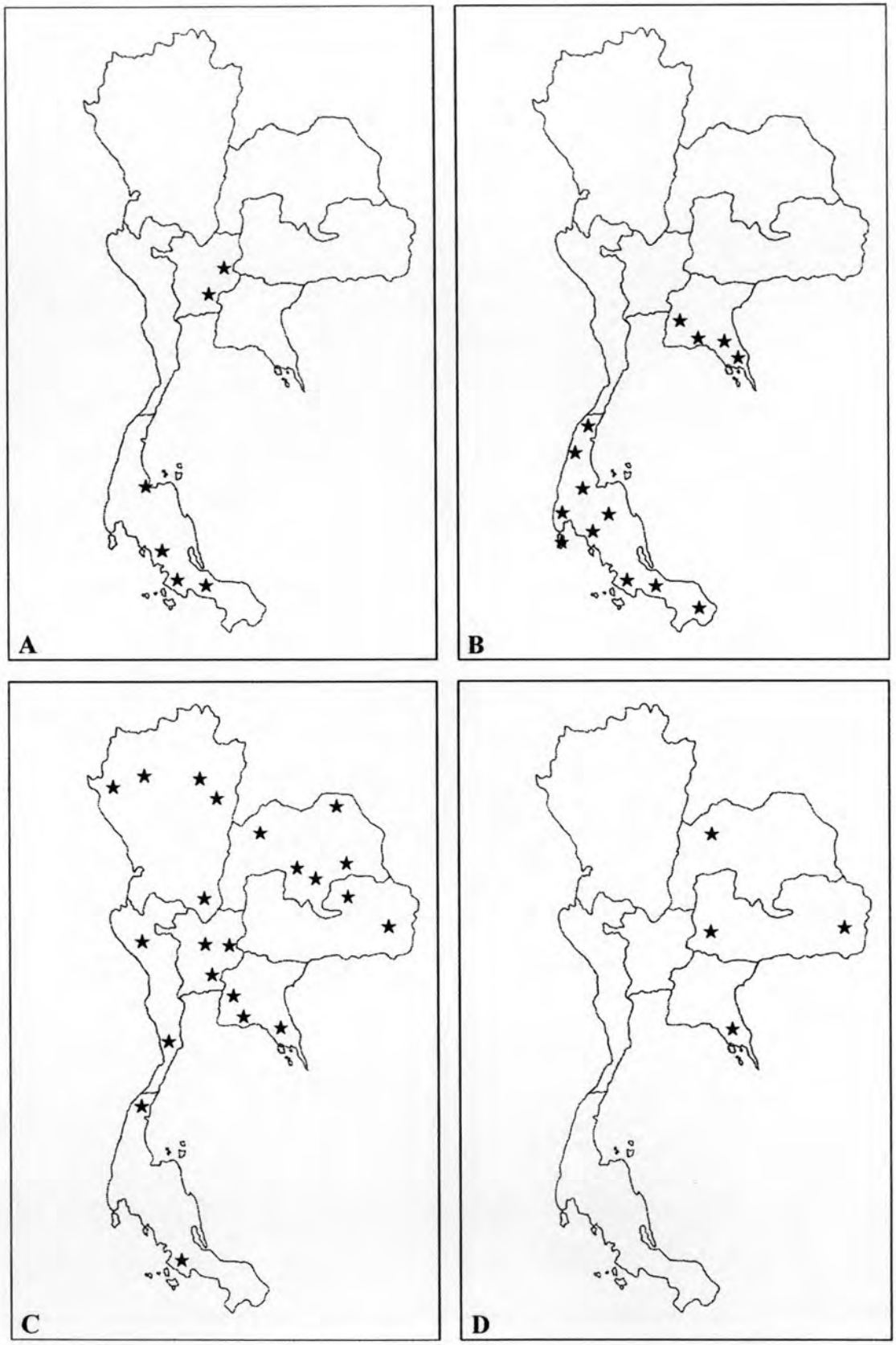

Figure 5.52 Distribution of *Ischaemum magnum* (A), *I. muticum* (B), *I. rugosum* (C) and *I. tenuifolium* (D).

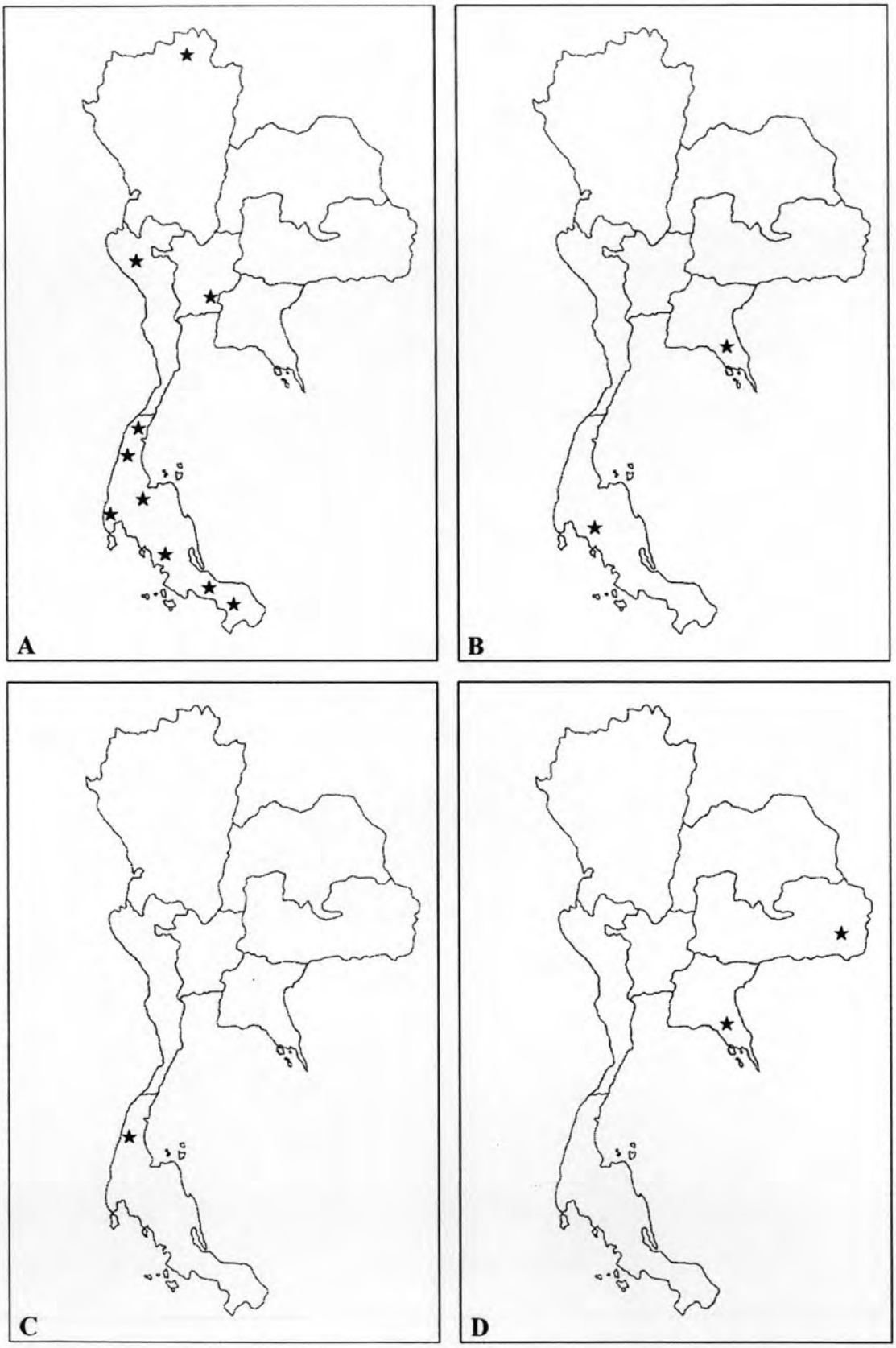

Figure 5.53 Distribution of *Ischaemum timorense* (A), *I.* sp. 1 (B), *I.* sp. 2 (C) and *Kerriochloa siamensis* (D).

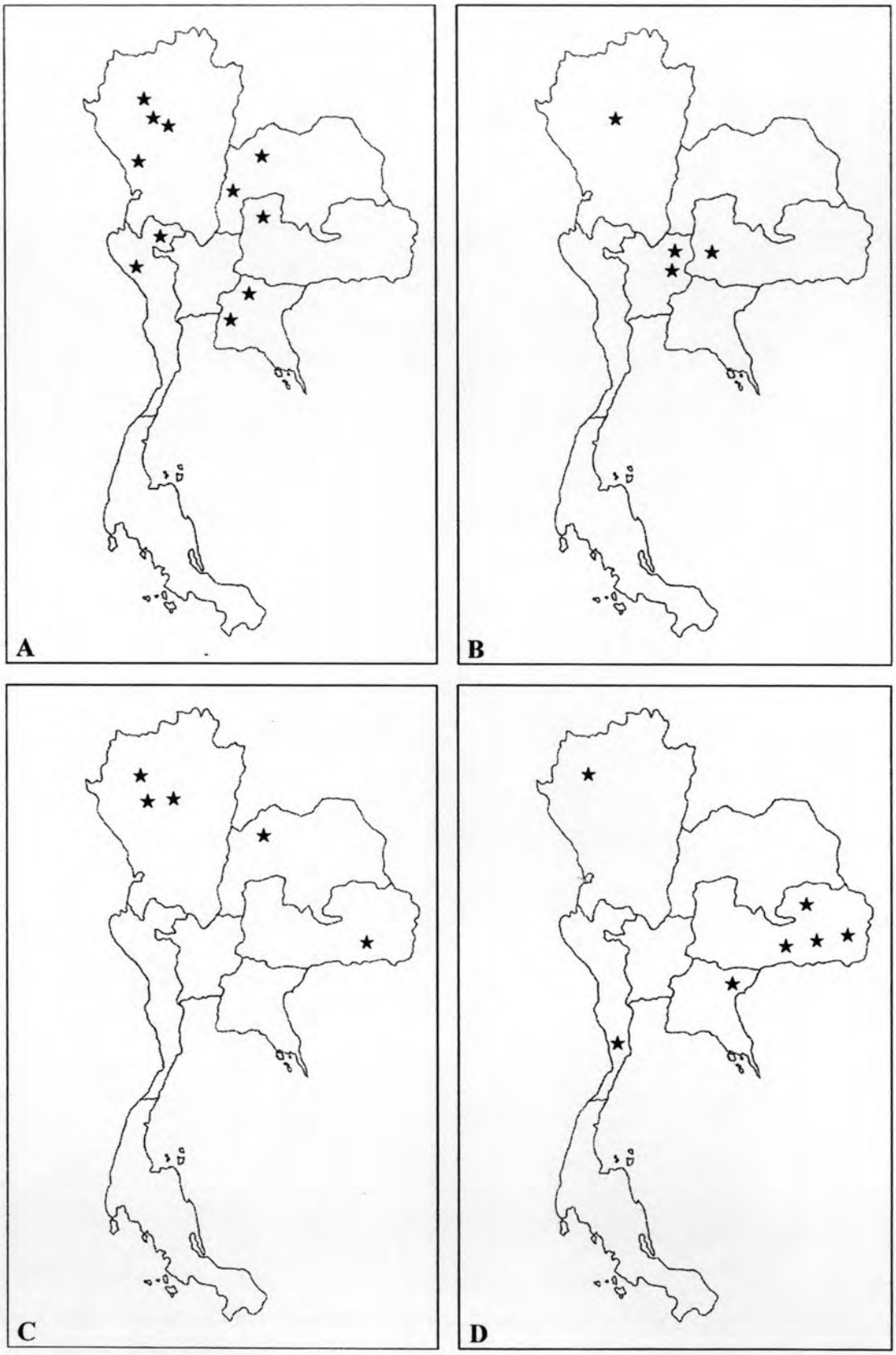

Figure 5.54 Distribution of *Sehima nervosum* (A), *Thelepogon elegans* (B), *Eremochloa attenuata* (C) and *E. bimaculata* (D).

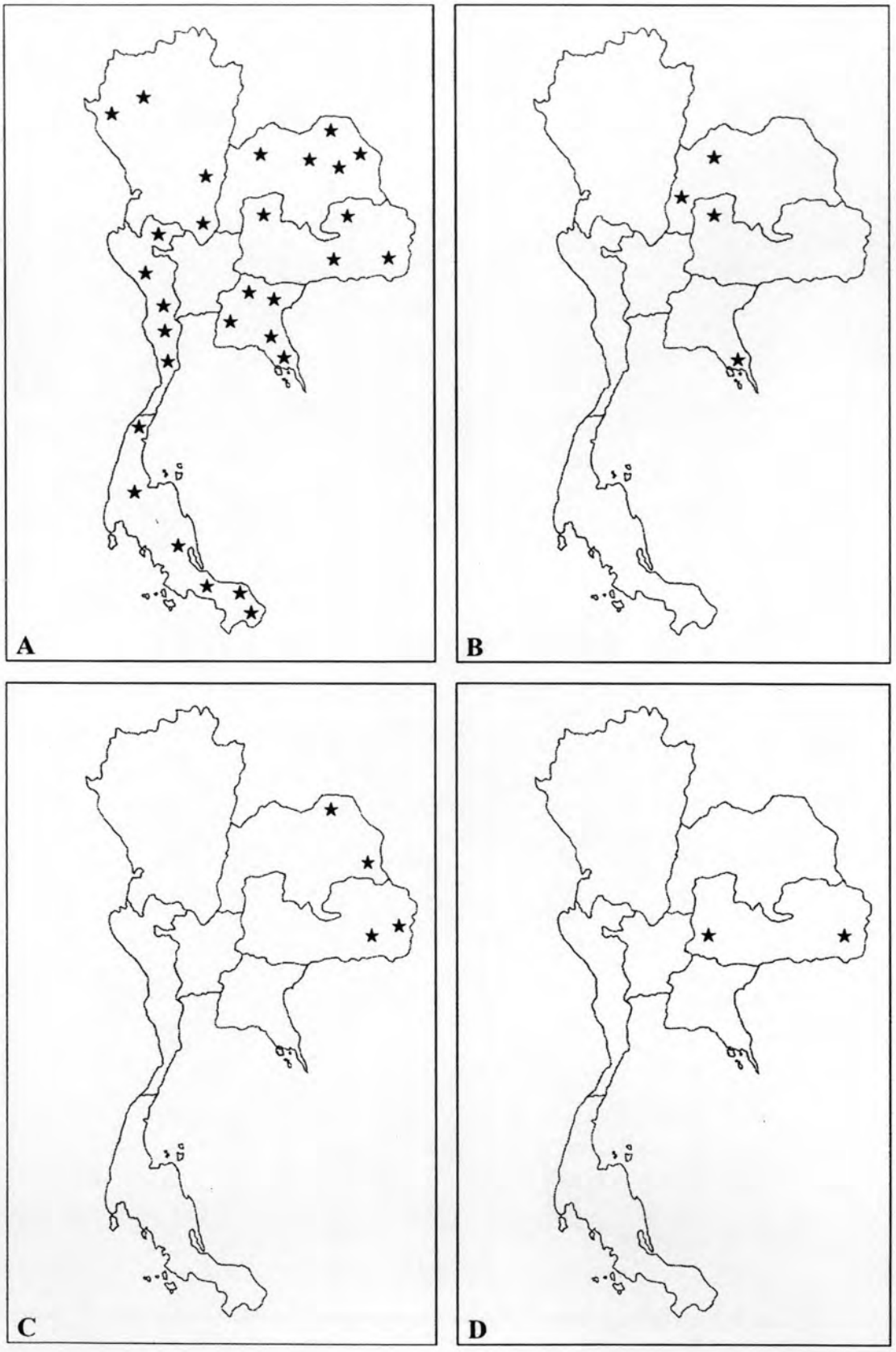

Figure 5.55 Distribution of *Eremochloa ciliaris* (A), *E. ciliatifolia* (B), *E. eriopoda* (C) and *E. lanceolata* (D).

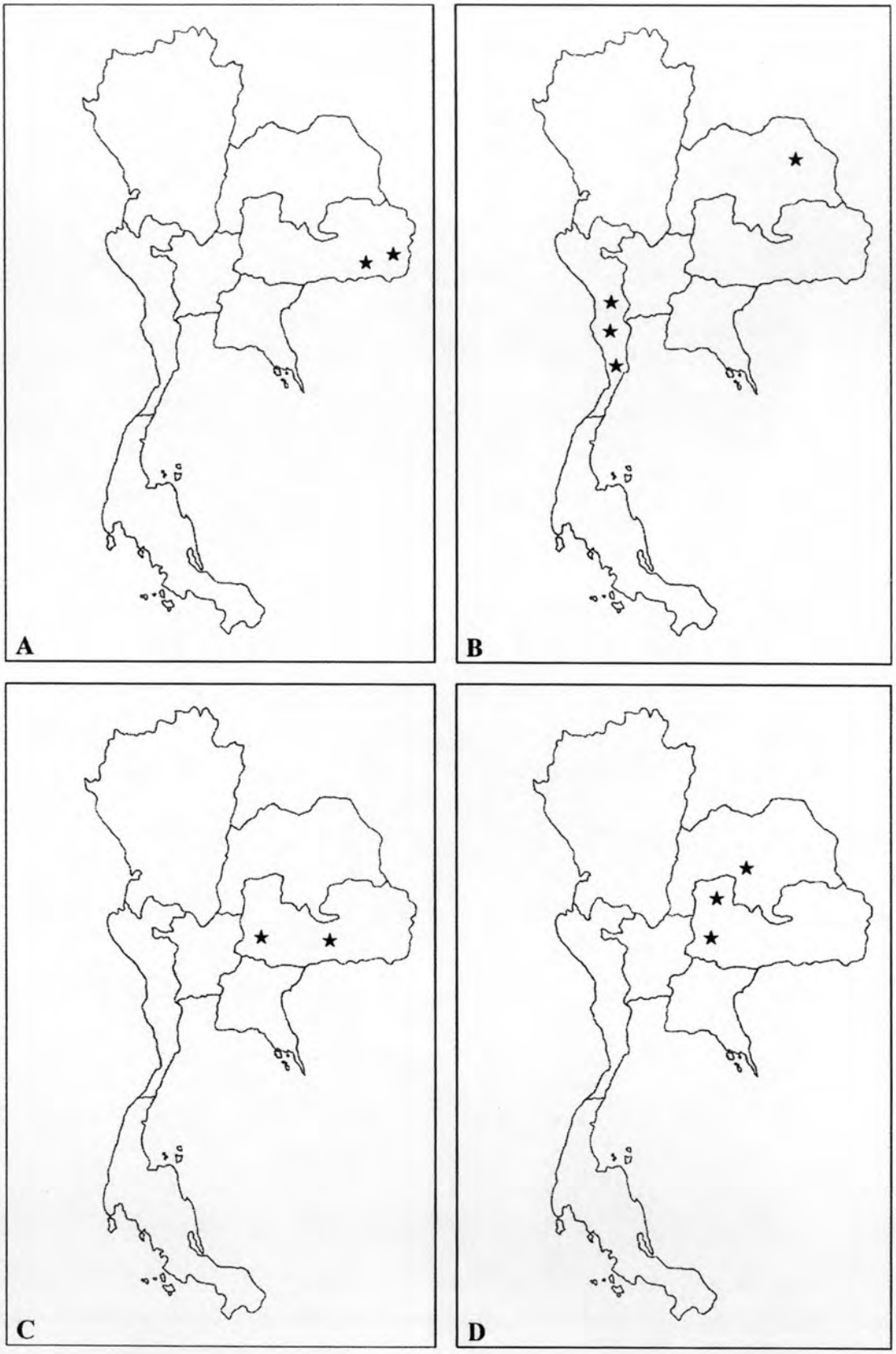

Figure 5.56 Distribution of *Eremochloa maxwellii* (A), *E. muricata* (B), *E. peltelotii* (C) and *E.* sp.1 (D).

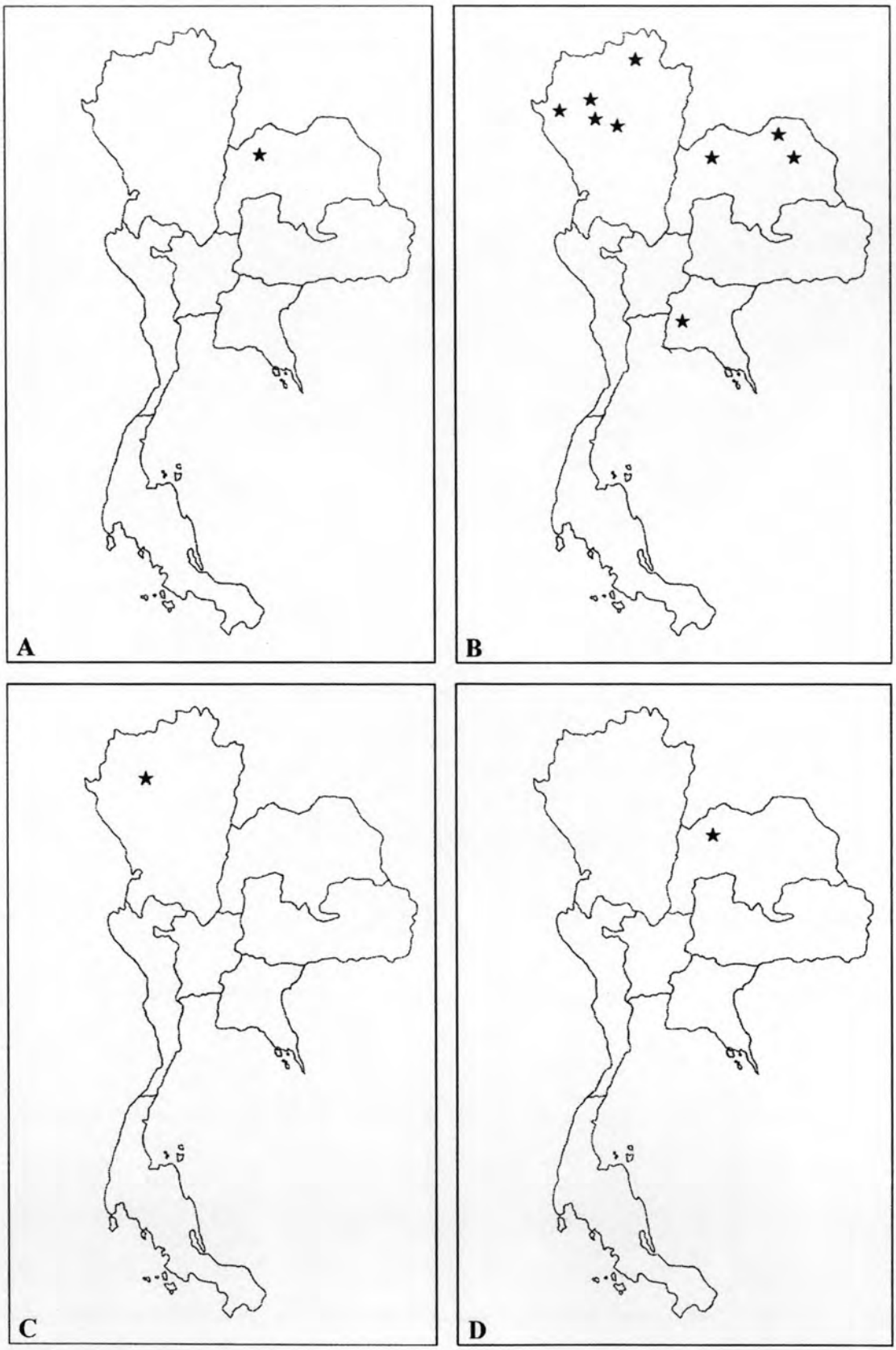

Figure 5.57 Distribution of *Eremochloa* sp. 2 (A), *Hackelochloa granularis* (B), *H. porifera* (C) and *Hemarthria altissima* (D).

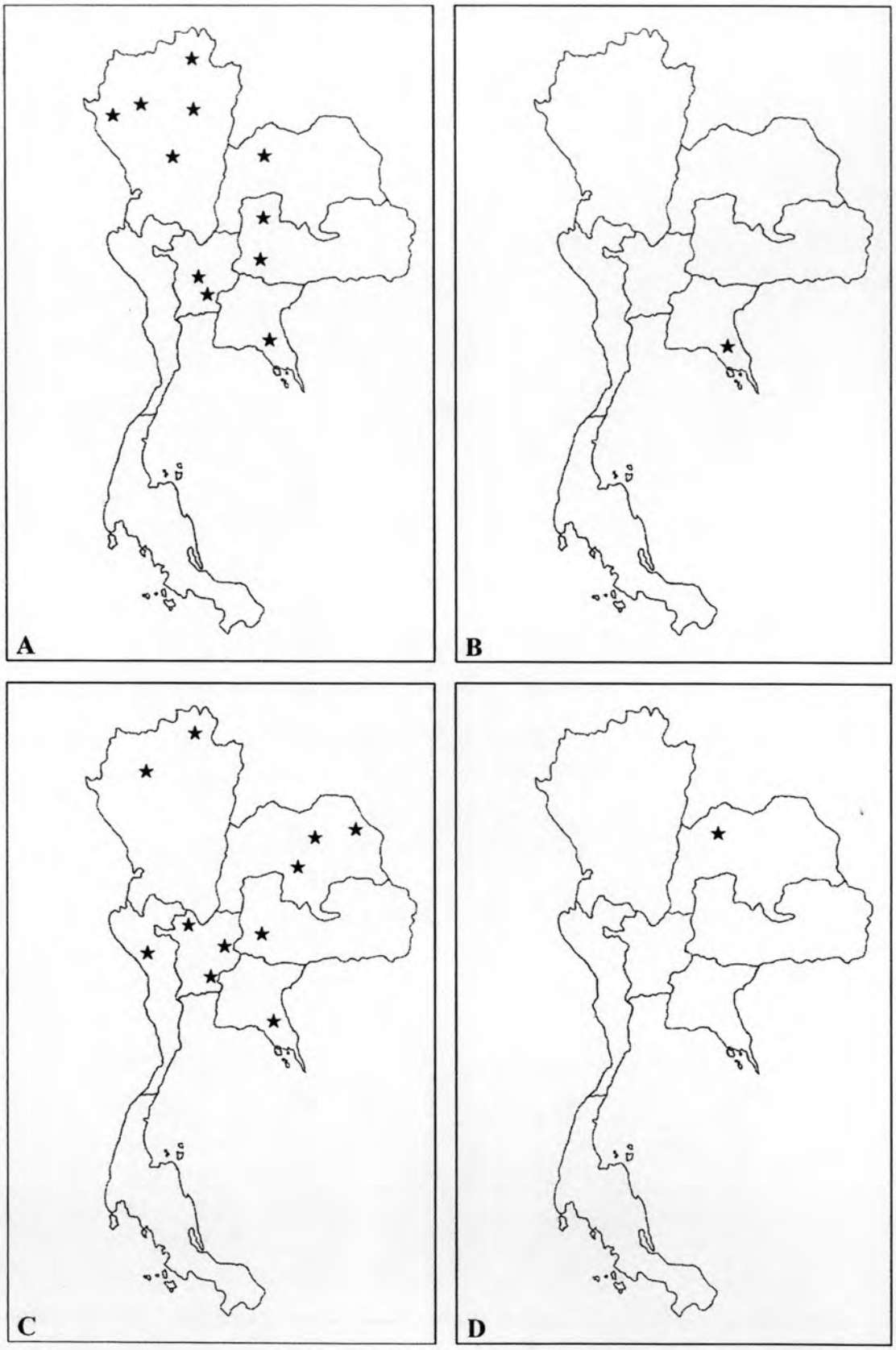

Figure 5.58 Distribution of *Hemarthria compressa* (A), *H. debilis* (B), *H. longiflora* (C) and *H. pratensis* (D).

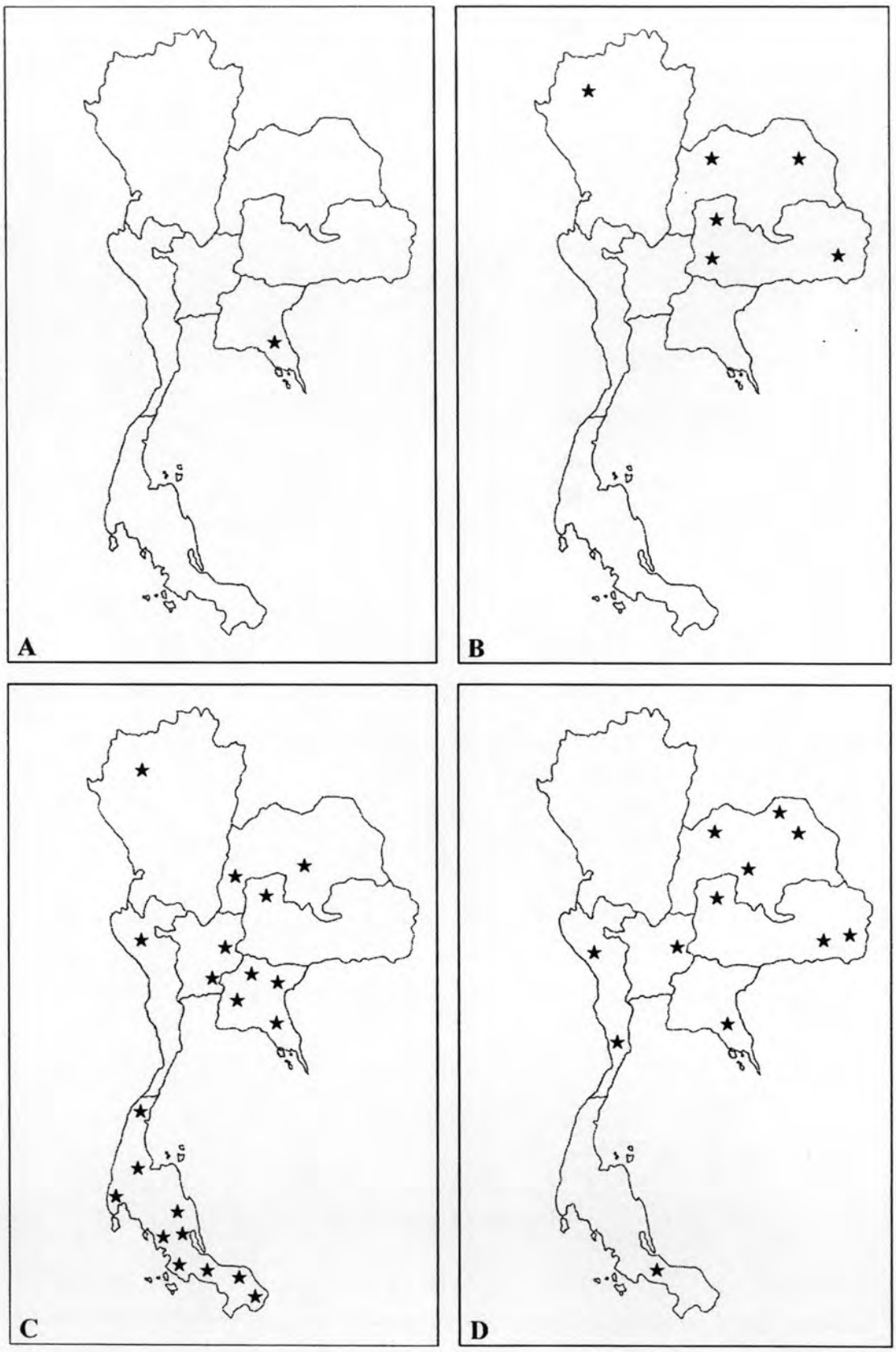

Figure 5.59 Distribution of *Hemarthria stolonifera* (A), *Mnesithea cancellata* (B), *M. glandulosa* (C) and *M. helferi* (D).

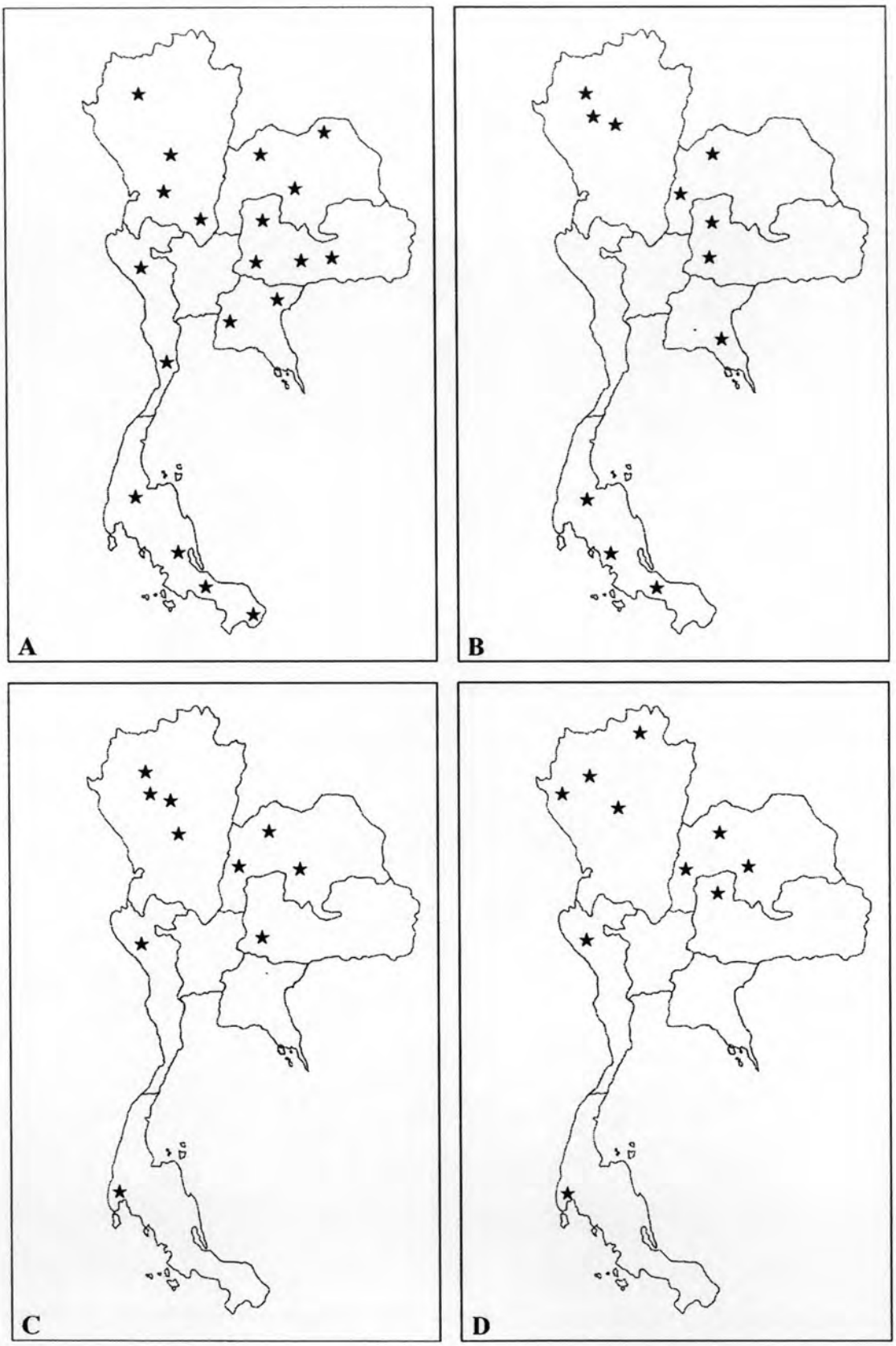

Figure 5.60 Distribution of *Mnesithea laevis* (A), *M. mollicoma* (B), *M. striata* (C) and *M. striata* var. *pubescens* (D).

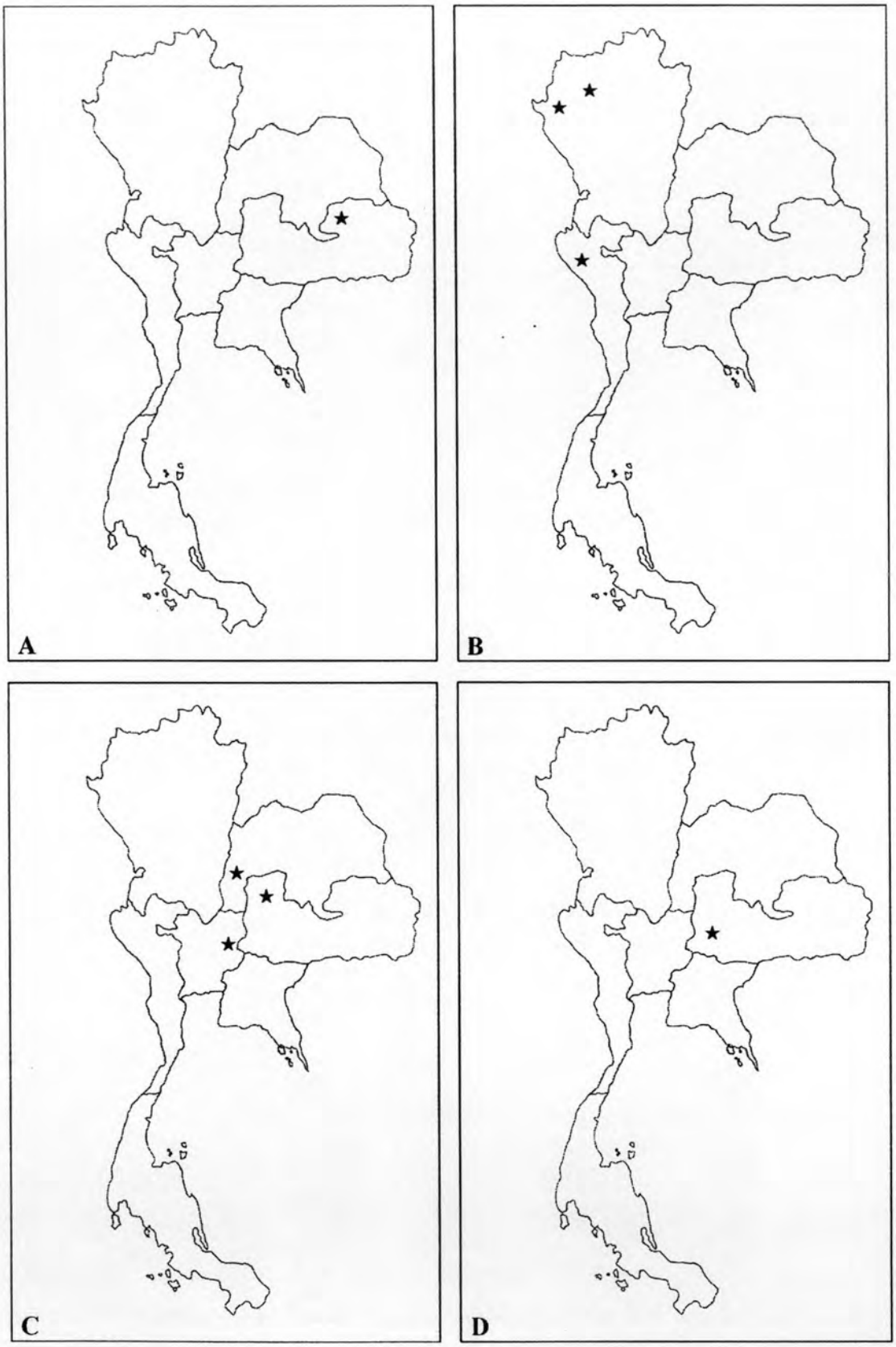

Figure 5.61 Distribution of *Mnesithea thailandica* (A), *M.* sp. 1 (B), *Ophiuros exaltatus* (C) and *Phacelurus cambogiensis* (D).

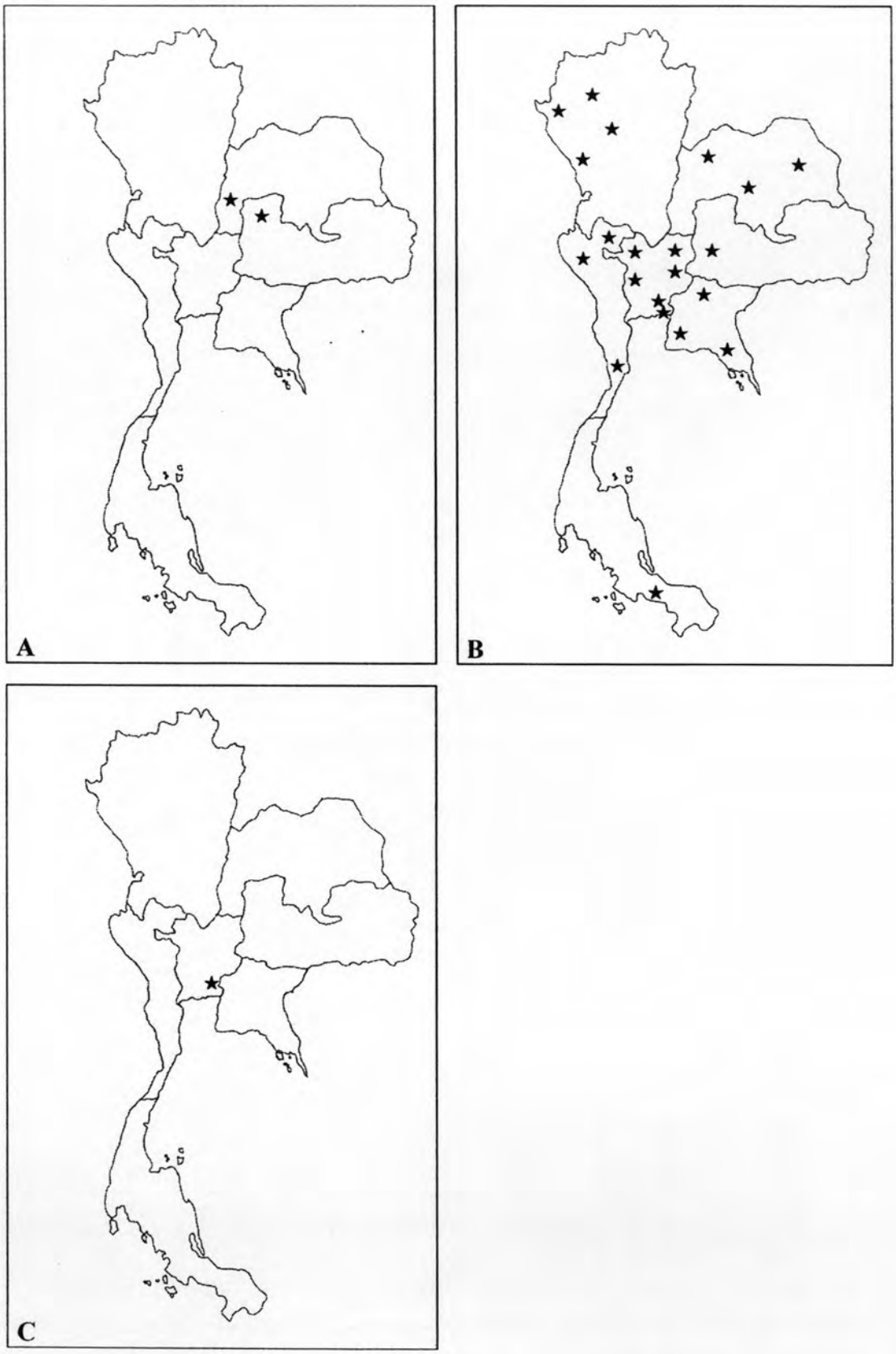

Figure 5.62 Distribution of *Phacelurus zea* (A), *Rotboellia cochinchinensis* (B) and *Vossia cuspidata* (C).